SCIENTIFIC AMERICAN

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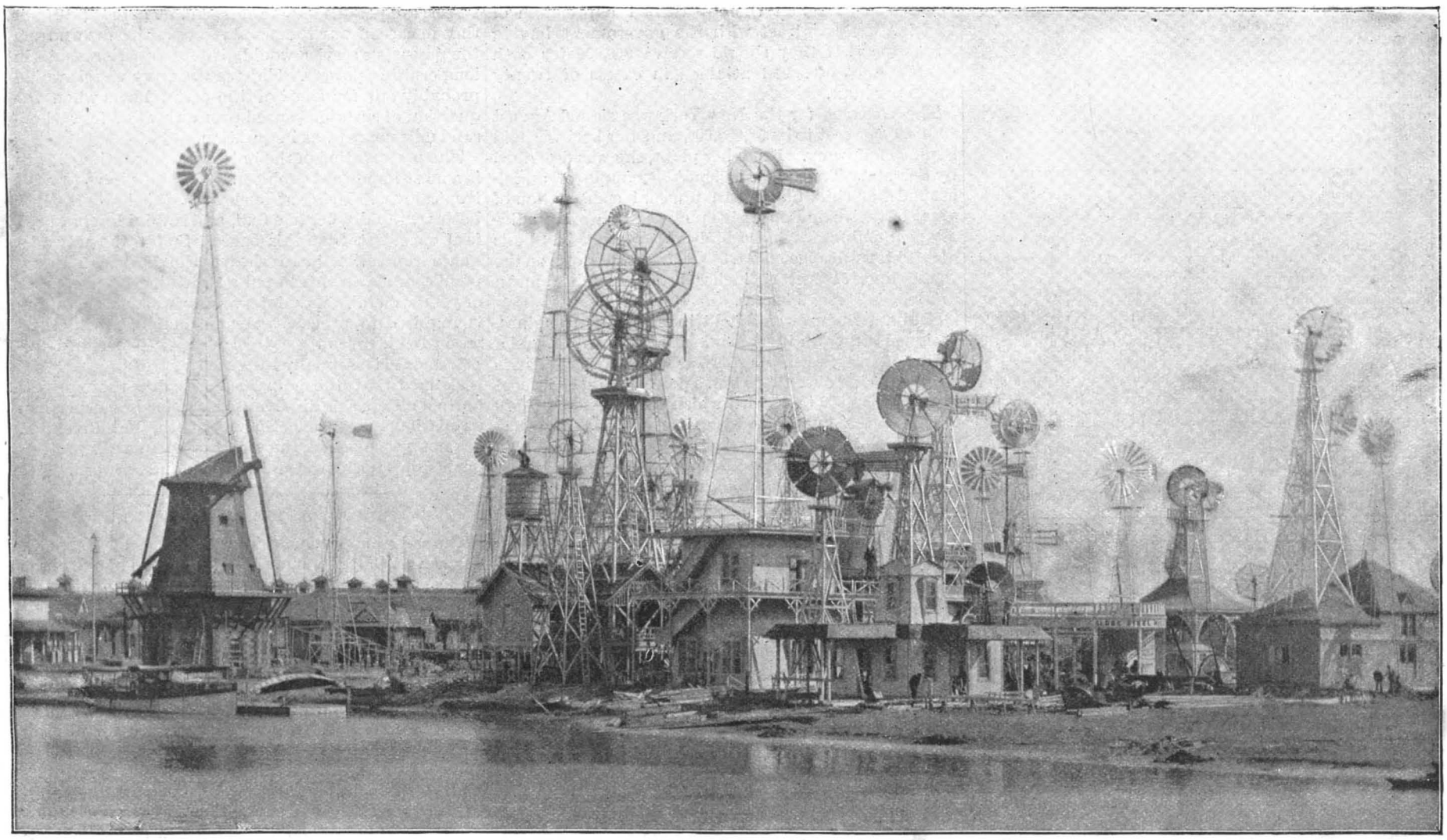

THE WORLD'S COLUMBIAN EXPOSITION—THE EXHIBIT OF WINDMILLS.—[See page 339.]

THE WORLD'S COLUMBIAN EXPOSITION—THE PALACE OF AGRICULTURE.—[See page 339.]

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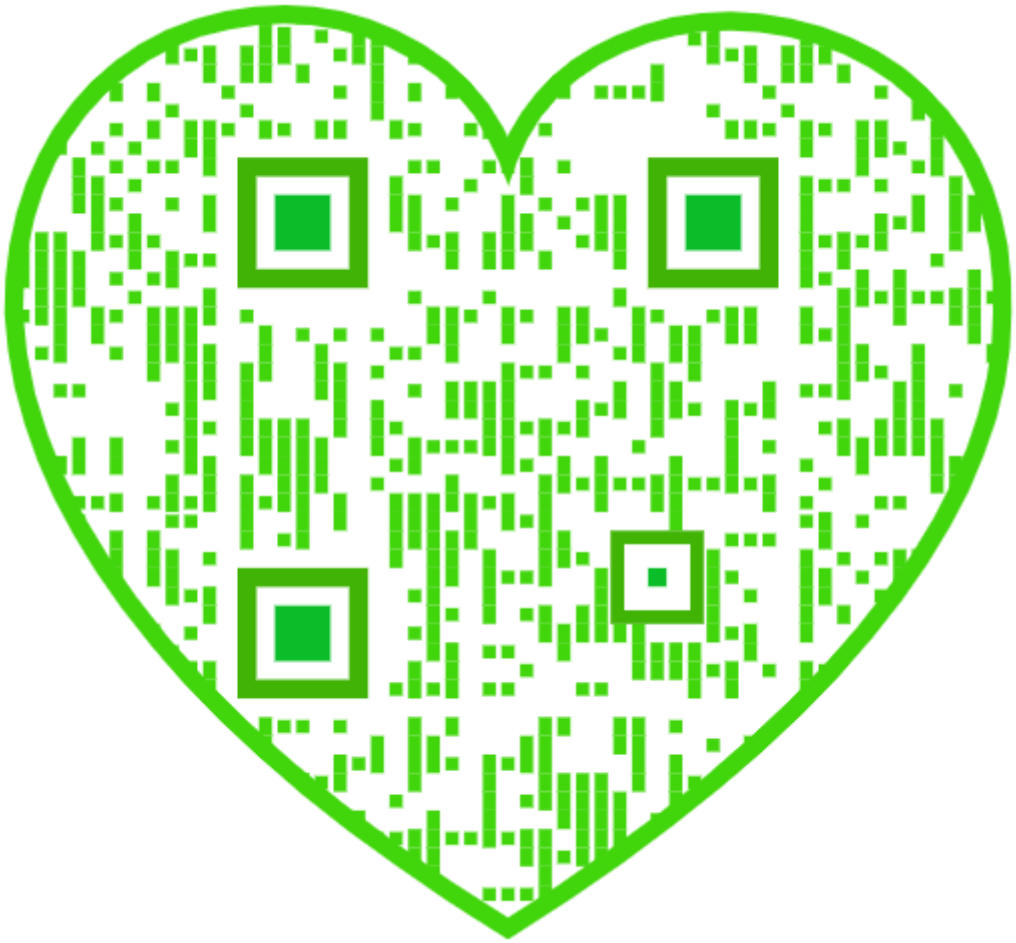

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SATISFACTORY TRIAL OF THE WAR SHIP NEW YORK.

The official trial of the New York took place at sea on May 22, over a 40 knot course, off the coast of Massachusetts, and the new cruiser has come up to expectations, showing an average speed of more than twenty-one knots per hour for four hours, although she had been designed to make only twenty knots.

The revolutions of the engines averaged 135, boiler pressure 168 pounds, and the average speed for the four hours was given approximately by Admiral Belknap, the head of the trial board, as 21 1-10 knots, with a possibility of slight correction for tidal influences. This fine performance was especially satisfactory to the builders of the New York, the Messrs. Cramp, as they had thereby earned a premium of $200,000, their contract with the government having stipulated that they should receive $50,000 for each quarter knot of speed attained in excess of twenty knots per hour.

The contract for the New York was signed August 28, 1890, her cost to be $2,985,000, and her keel was laid Sept. 30 following. From her plans, she was described by Secretary Tracy as a splendid example of an all-around war ship, having an unusual combination of great offensive and defensive powers with extraordinary coal endurance and a high rate of speed. She is of 8,150 tons displacement, 380 feet 6 inches long on the water line, 64 feet 10 inches broad, and her mean draught is 23 feet 3 inches.

She has twin screw vertical triple-expansion engines, designed to furnish 16,500 maximum horse power, and a report of the trial shows this was exceeded, the figures as given being over 17,000 horse power. She has a coal capacity of 1,500 tons, with which she can steam 13,000 miles at a ten knot rate without recoaling. She has four complete decks, including the flying deck or bridge that carries the boats, and her protective deck of steel is 6 inches thick on its sloping side portions, which extend 4¾ feet below the water line. Coal may be also so stowed on the armor deck as to afford further protection.

The main battery of the New York consists of six 8-inch and twelve rapid-fire 4-inch guns; her secondary battery of eight 6-pounder and four 1-pounder rapid-fire guns and four Gatlings. What particularly struck the British Vice-Admiral Hopkins in inspecting the ship was the excellent protection given to the guns, which is far superior to anything on the Blake. The barbettes of four of the 8-inch guns have a thickness of ten inches, and the conical revolving shields on the same guns are seven inches thick. The sloping armor beneath the barbettes between the upper and the gun deck is five inches thick, as are also the ammunition tubes. The four broadside 8-inch guns have a protection of two inches. The 4-inch guns are mounted in sponsons four inches thick, with protective shields covering the ports. Even the 6-pounders have two-inch protection. Her freeboard to the upper deck is about twenty feet, and her 8-inch guns are twenty-five feet above the water line, so that they get an effective fire in all conditions of the sea. There are six above-water torpedo tubes, one at the bow, one at the stern, and two on each broadside. She has no sail power, but carries two military masts with double fighting tops.

As seen at anchor just before her trial trip, the new cruiser is said to have looked like a steamship of strong rather than graceful lines, her breadth giving an impression of power, which was intensified as the development of her great speed was exhibited. She was rough looking, not yet having had her finishing touches, but in her thorough efficiency and evident adaptation for the uses for which she had been built, she commanded the unqualified admiration of the large group of able officers which had been brought together to pass judgment upon her.

THE MAINTENANCE OF THE SPEED OF WAR SHIPS.

We elsewhere give the record of the remarkable trial trip of the armored cruiser New York, as made off the New England coast. Last March her unofficial trial trip showed a speed exceeding twenty knots. Then she was accorded first rank among the war ships of the world. Her official trial corroborates that judgment. It shows how, in the matter of speed, an armored man-of-war can equal a passenger ship. The American line ships Paris and New York in speed compare with the new cruiser. Yet it is very doubtful if a year from now, without long preparation, the record of the trial trip of the war ship could be duplicated. The passenger liner on the other hand is kept going back and forth across the ocean at all seasons, without rest, and has to hold her average under all conditions. The cruiser, for four hours with forced draught, driving showers of burning coals out of her smoke stacks, shows a speed not much greater than the modern passenger ship has to keep up day and night under quiet steaming for a week at a time. The heavy armored war ship, compared with the ocean liner, suggests the working horse and the racer. The four-hour trial is a *tour de force;* the true record would be given by a run from Sandy Hook to Queenstown and return.

Nothing is more definitely settled than the deterioration in steaming qualities of naval vessels. In their naval reviews and competitions the British authorities have found the greatest discrepancies between claimed speed and that attained in practice. This is independent of accidents. Often a long trip of a modern naval cruiser is a chronicle of breakdowns; leaky boiler tubes, and troubles with the machinery are noted with a frequencp which would be very disastrous to the ocean passenger service, if such ships as the Campania or Paris were subject thereto. But the liners appear to be free from such disturbances. It seems as if the only way to maintain a ship in good condition is to keep her in action. The long periods of rest of the naval vessels are periods of deterioration. There is no doubt that in case of war the naval reserve ships drawn from the passenger service would give far superior results in long cruising powers. The regular navy vessels would probably fall far short of the ocean liners when the question of sustained speed over a three or four thousand mile course was in question.

The preservation of the bottoms from marine growth is a most important problem. Our ships have to visit tropical seas. Lying at anchor in the harbors, their bottoms rapidly become foul, and several knots speed is at once lost from this cause. So far, the only adequate protection is to sheath the hull with heavy planks, and over this to put a sheathing of copper or of yellow metal. The intervening wooden sheathing is required to prevent galvanic action, which otherwise would corrode the steel plates. The ship's displacement is materially increased by this process; but is claimed that the gain in speed due to improved bottom offsets this disadvantage. Zinc and other materials have been experimented with, but invention has not yet reached the point of adequately protecting a ship's bottom from barnacles and seaweed.

DEATH OF MOSES G. FARMER.

The sad announcement of the death of Moses G. Farmer, at Chicago, marks the departure of one of the pioneers of modern electricity. He was so anxious to see the electrical exhibit at the Columbian Fair that he went to Chicago, it is said, against the advice of his physician. He contracted a cold and died there of pneumonia on May 25, aged 73 years. He was born Feb. 9, 1820, at Boscawen, N. H., and graduated from Bowdoin College in 1844. He at once began his life's work in electricity. In 1846 he invented an electro-magnetic engine which he used to drive a car on a model railroad. He next became engaged in telegraphy. Telegraphing by induced currents, the application of the current to submarine blasting and to torpedoes, and apparatus for striking fire alarm bells engaged his attention during these early days. He was appointed superintendent of the Boston Fire Alarm Telegraph, appearing as one of the pioneers in electric fire signaling. He early made experiments in dial telegraphy and in duplex and quadruplex transmission, his patent on duplex transmission dating back to 1858. In Thompson's *Electro-Magnet* he is cited as one of the early discoverers of the principle of self-excitation of the dynamo. This was in October, 1866. His other work covered a wide field of experimentation, including investigations of the velocity of light, electric registering apparatus, distribution of current for electric lighting, determination of the velocity of circulation of the blood and other subjects. Several of his inventions were exhibited at the World's Fair, and are spoken of as among the interesting features of the display. In spite of his advanced age, he is described as most enthusiastic over the electrical display. For many years he was attached to the United States navy torpedo station at Newport, R. I.

A EUROPEAN authority on cholera believes that cholera can be exterminated by going to the root of the evil. This disease is endemic at the delta of the Ganges River in India, in a low area of about 7,500 square miles, caused by the putrefying remains of animal and vegetable life cast into the river by the inhabitants and constantly floating about. Formerly the fellaheen of Egypt interred their dead on the borders of the river Nile, and the bodies were then washed out into the stream during the annual overflow of the river, and were carried down to spread disease throughout the delta. Since an end has been put to this custom, the plague no longer harasses the country. It would doubtless be difficult, if not impossible, to restrain the natives of India, inhabiting the region of the Ganges, from casting their dead into the waters of the sacred stream; but the author thinks this difficulty might be obviated by compelling the people to cremate their dead and then throw the ashes on the bosom of the river.

THE triple expansion engine for ships was first designed by Peter Ferguson (of Fleming & Ferguson, of Paisley), who fitted them on board ship in 1872. To the late Dr. Kirk, however, is due the general adoption of this class of engines, through the clearness with which he demonstrated their superior economy.

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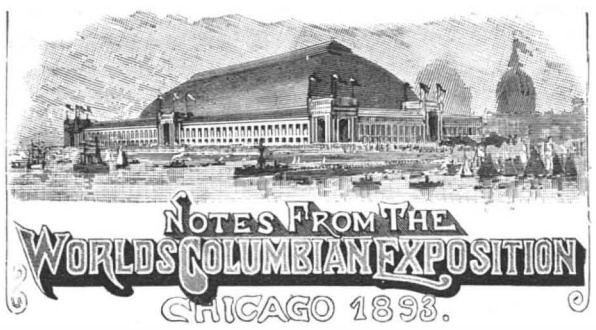

Probably the finest view of the Agricultural building is that presented on our front page, which was taken from the colonnade story of the Administration building, looking toward the southeast. The water in the foreground and at the left is part of the Basin, while passing under the bridge and to the right of the picture is what is called the South Canal, a body of water which separates the Agricultural Palace from the Palace of Mechanic Arts.

The front of the Agricultural Palace faces the Basin and is directly opposite the south end of the Palace of Manufactures and Liberal Arts. The ground in front of each of these edifices is terraced and laid out with walks. Our view of the Palace of Agriculture building shows the large amount of statuary used in ornamenting this structure. This statuary and other ornamentations of the building were described in the SCIENTIFIC AMERICAN of April 29. The palace is approached from the main part of the grounds by means of the bridge shown in the foreground at the right or by passing over another bridge at the head of the Basin which is just beyond the northeastern corner of the building. There are several entrances, and the internal arrangement is such that from whatever direction the visitor enters, many most interesting objects are presented to the view.

The Palace of Agriculture, next to the Administration building, is probably more conspicuous than any other edifice at the World's Columbian Exposition in the amount of statuary and other ornamentation. The architecture of the building is that of the Classic Renaissance style. It fronts on the Basin and is directly opposite the south end of the Manufactures and Liberal Arts building. At the west of it is the South Canal, which separates it from the Palace of Mechanic Arts, while in the rear, or east of it, is what is called the South Pond. The Palace of Agriculture, like all the other Exposition buildings, is covered with staff, which, as our readers will remember, is composed of plaster of Paris, with which fibers of hemp are mixed, to impart increased strength. It is 800 feet long from east to west, and 500 feet wide from north to south. The cornice line, like all the other buildings surrounding the Basin, is 65 feet above grade. The main entrance is on the north face of the building, and on either side of it are mammoth Corinthian pillars, 50 feet high and 5 feet in diameter. Pavilions are reared at each corner and from the center of the building, the center one being 144 feet square. Curtains connect the corner pavilions, forming a continuous arcade around the top of the building. Each corner pavilion is surmounted by a dome 96 feet high, and on each of these domes is a group of maidens of heroic size, called the Horoscope Group. These figures are represented as holding aloft a globe, about which is a zone with signs of the zodiac. The figures are made of staff, while the globes are of sheet copper. Each group represents a distinct race, one the Caucasian, another the Mongolian, another the Ethiopian, and the fourth the American Indian.

The main entrance leads through an opening sixty-four feet wide into a vestibule, and from this vestibule into the rotunda, which is one hundred feet in diameter. This rotunda is surmounted by a mammoth glass dome 130 feet high.

Thirty-seven States in this country and thirty-five foreign nations and states have exhibits in this building. The interior arrangement is such as to provide over fourteen acres of desirable space for purposes of exhibiting.

Our plate of the Palace of Agriculture was prepared from a photograph specially taken for the SCIENTIFIC AMERICAN.

Immediately back of the annex there is what is called the South Pond, and on the western shore thereof is the exhibit of wind mills shown in our front page illustration. This picture was taken from the railway platform back of the annex looking across the South Pond. There are fourteen different makes of mills in this collection besides a reproduction of an ancient Dutch wind will. The latter is a model of a mill built in Amsterdam in 1806, being the original mill built to furnish power for Blooker's cocoa manufactory. The mill at the left is raised above a structure resembling the Dutch structure. Most of the mills have in connection with them a full complement of the various machines used in connection with them, showing the many uses to which these wind mills can be applied. Inclosed among these devices are pumps in variety, churns, feed cutters and grinding machines, etc. The manufacturers represented in this wind mill exhibit are the following: The Aer-Motor Company, Batavia, Ill.; the Althouse-Wheeler Company, Waupum, Wis.; Flint & Walling Manufacturing Company, Kendallville, Ind.; Stover Manufacturing Company, Freeport, Ill.; Mast, Foos & Co., Springfield, Ohio; Challenger Wind Mill and Feed Mill Company, Batavia, Ill.; United States Wind Engine and Pump Company, Batavia, Ill.; Decorah Wind Mill Company, Decorah, Iowa; the American Well Works, Aurora, Ill.; Sandwich Enterprise Company, Sandwich, Ill.; Baker Manufacturing Company, Evansville, Wis.; Globe Wind Mill Company, West Pullman, Ill.; Eclipse Wind Engine Company, Beloit, Wis.; E. B. Winger, Chicago, Ill. Our plate of the wind mill exhibit was prepared from a photograph specially taken for the SCIENTIFIC AMERICAN.

Two interesting dedications took place at the World's Columbian Exposition grounds during the week ending May 20. The first one on May 17 was that of the Norwegian building. This building is an attractive structure about the average size of the State and national buildings, situated in the northern part of the grounds just east of the Gallery of Fine Arts. The exercises were attended by several thousand Norwegians living in the city of Chicago and vicinity, and the principal speakers included Norwegians who had attained eminence politically and otherwise. The fact that the 17th of May was a national day with the Norwegians brought out a larger attendance than there otherwise might have been. This was the first dedication at which there were formal exercises and which were attended by a large procession since the opening of the Exposition grounds on May 1. The procession included a dozen or more Norwegian organizations, and in the procession as well as in the decoration of the building the Norwegian and American flags were conspicuous. The principal address was by Professor Julius E. Olsen of the University of Wisconsin. Other speakers were Governor Knute Nelson, of Minnesota, and Congressman Haugen, of Wisconsin. In the evening a banquet was held at one of the leading hotels at which eminent Norwegians were guests.

On the following day the Illinois State building was dedicated. This structure is the largest State building on the grounds and is also one of the most conspicuous buildings, the dome being visible from almost any point in the grounds because of its height. The building is situated on the shore of the north pond and not far from the Fifty-ninth Street entrance to the Exposition grounds. Whatever may be said regarding the architecture of this building, certain it is that the interior arrangements fill all the requirements. This structure, like all the Exposition buildings, is covered with staff and is quite elaborately ornamented. The dedicatory exercises were held in front of the main entrance on the south side of the building overlooking the lagoon. Near by is the Woman's building. The day on which the exercises were held was pleasant and comfortable, and although seating arrangements were provided for about two thousand people, there were nearly twice as many as that number in attendance. Addresses were made by Mr. Lafayette Funk, president of the Illinois Board of World's Fair Commissioners, Mrs. Marcia Gould, president of the State Woman's Board, Governor Altgeld, Mayor Harrison and others. The orator of the day was Mr. Frank H. Jones, of Springfield. After the exercises the building was formally inspected by the people present and by many visitors who were in the grounds. The exhibits in this building are all installed and include a great variety of subjects. The display of the products of the soil is very complete and elaborate as well as beautifully arranged, and is one that should not be overlooked by intended visitors. Products of the field are fully shown, as also those of the forest, and there are exhibits by schools and colleges, a large number of pictures, some of them of considerable merit, and also a grotto with fish ponds. The fishes include most of those found in the waterways of the State. There are also a number of German carp of considerable size. On the north side of the building is a fireproof annex in which are shown battle flags and other trophies by the Grand Army of the Republic and other military organizations.

The first congress in the series of congresses in connection with the World's Fair Auxiliary was held in the Memorial Art Palace on the Lake Front in Chicago for the week of May 15 to 21 inclusive. This was the Congress of Representative Women, some sixty or more organizations and a much larger number of societies and associations devoted exclusively to the interest of women being represented. There were three general organizations of the work of the congress—the general congresses, which were held in the large hall and which were opened to the public; the report congresses, which reported from associations and societies in all lines of work and from different parts of the world; and the congresses of the larger organizations, which were fully represented, and at the meetings of which papers were read and discussions held. The entire congress was divided into eight departments—education, industry, literature and art, philanthropy and charity, moral and social reform, religion, civil law and government, and science and philosophy. The more important papers read in the general congress referred entirely to woman's work and influence, several papers being read by eminent women in each of the eight departments. Among the more important meetings of well-known organizations were the following: National Congress of Women of the United States, Order of the Eastern Star, International Committee of Young Women's Christian Association, National Christian League for the Promotion of Social Purity, Woman's Christian Temperance Union, International Kindergarten Union, Woman's National Indian Association, National Association of Loyal Women of American Liberty, National American Woman's Suffrage Association, Woman's Baptist Home Mission Society, General Federation of Woman's Clubs, American Protective Society of Authors, Woman's Centenary Association, Catholic Woman's Congress, National Alliance of Unitarian and Other Liberal Christian Women, Non-Partisan National Woman's Christian Temperance Union, National Woman's Relief Society, Young Ladies' National Mutual Improvement Association, National Society of the Daughters of the American Revolution, International Council of Women, Woman's Trade Union, National Columbian Household Economic Association and many other societies and organizations. On Sunday, May 21, a series of religious meetings were held, conducted by women who have been admitted to the ministry in the several denominations. In addition to these and other meetings of more or less importance a series of society gatherings and receptions were held, continuing throughout the week.

In addition to these congresses, a series of meetings was arranged continuing during the remainder of the month of May, to be held in the Woman's building in the Exposition grounds, at which addresses are to be made by well known women of this country and of Europe.

The whaleback steamer Christopher Columbus, which was illustrated in these columns in the issue of May 13th, steamed into the harbor of Chicago on Friday, May 19. The vessel is not particularly fine in her lines and looks somewhat top-heavy, as noticed from the illustration; but in her accommodations she is finely fitted up, and is believed to be ample to carry 5,000 people, and as already tested has made a speed of about twenty miles an hour. The vessel had not been in harbor an hour before she was put into commission and took a large party of visiting editors out into the lake on an excursion.

A point not generally appreciated by people from the several States that have buildings in the Exposition grounds is the fact that there is a post office in each one of these buildings and also a registry. All visitors who do not care to have their mail sent to the World's Fair post office in the Government building can have it sent to their State building. An important feature in connection with these State buildings is that they are designed to serve as club houses, and many reunions of friends occur in this way every day, and friends can be found by consulting the registry, as the city address of each person registering is given.

Answer of the Bell Company.

The American Bell Telephone Company and E. Berliner have filed their answer to the bill lodged by the government to annul the Berliner patent in the United States Circuit Court for the District of Massachusetts.

The answer is a general denial of all the charges made in the government complaint, and avers that due diligence was observed in the prosecution of the case in the Patent Office; that as a matter of fact the patent was ready for issue as early as 1882, and that the patent would then have been issued but for the action of Examiner Brown, who rejected all its claims and raised other objections—all of which could have been done before that date. This action was appealed from to the Board of Examiners-in-Chief, who, in February, 1889, reversed the decision of the examiner. It is also averred in response to the complaint that no new matter was introduced into the amended specification filed in 1880, after the acquisition of the patent by the Bell Company.

The Bell Company also aver that in the applications for the Berliner patent, all due forms of law were observed, and that the government cannot repudiate the acts of its own agents established by the laws creating the Patent Office.

Scientific American and the Columbian Exposition.

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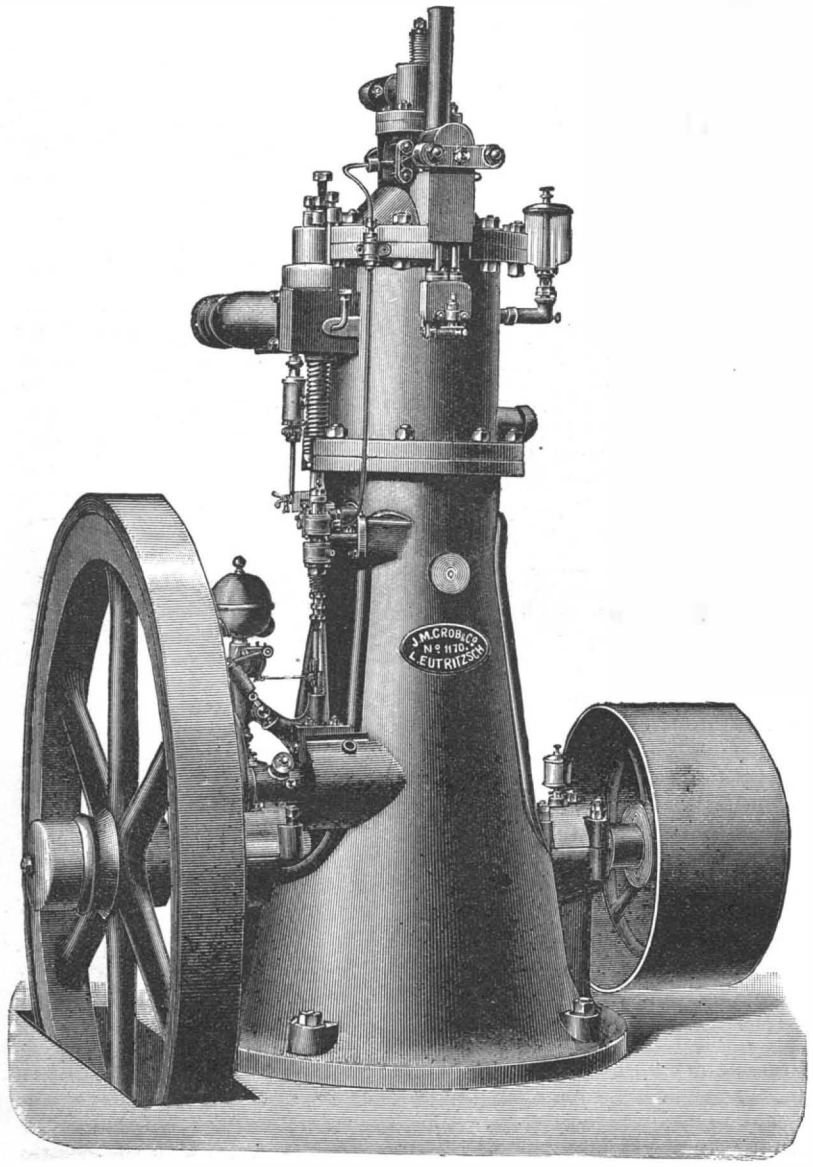
PETROLEUM ENGINE EXHIBITS AT THE WORLD'S COLUMBIAN EXPOSITION.

Among the interesting exhibits in the German department at the great Exposition in Chicago are some elegant specimens of engines operated by petroleum only, no steam boilers being used. They are from the famous establishment of Grob & Co., at Leipzig-Eutritzsch. The petroleum is heated and converted into



THE COLUMBIAN EXPOSITION.—Fig. 1.—J. M. GROB & CO.'S EIGHT HORSE POWER PETROLEUM MOTOR.

gas, so that the machines are, practically, gas engines. A machine of this kind is shown in the annexed engravings, in which Fig. 1 gives the general appearance of the stationary type; Fig. 2 shows a portable engine applied to wood sawing and splitting; and Fig. 3 shows a launch propelled by a 4 horse power Grob oil engine.

The power in these engines is generated by means of common kerosene oil such as is burned in lamps. This oil is atomized, gasified, mixed with a proper proportion of air, compressed and ignited behind a piston, producing the pressure necessary to propel the piston and parts connected therewith. The speed of the engine is regulated by varying the supply of oil. The ordinary speed is from 250 to 400 revolutions per minute, according to the size of the engine, but an attachment is provided by which the speed can be reduced to 150 revolutions per minute. These engines range from ½ horse power to 30 horse power. We understand that further preparations are being made for making larger sizes. The engine occupies very little floor space, as will be seen by reference to Fig. 1; and where the machine is designed for use as a portable engine, the engine and accessories are mounted on a platform wagon. The amount of oil consumed in engines of the larger size is about a pint per horse power per hour; for smaller engines, about a pint and a half per horse power per hour.

Messrs. Grob & Co. claim to have been the pioneers in the construction of oil engines, and they have at Leipzig the largest oil engine factory in Europe. This engine is now being introduced into this country, and a number of them are on exhibition at the Columbian Exposition in Chicago, in Section F, No. 1,526.

The exhibit consists of 1 horse power, 2, 6, 8 and 10 horse power petroleum motors, a 2 horse power gas motor, a 4 horse power portable engine and one 6 horse power petroleum motor launch.

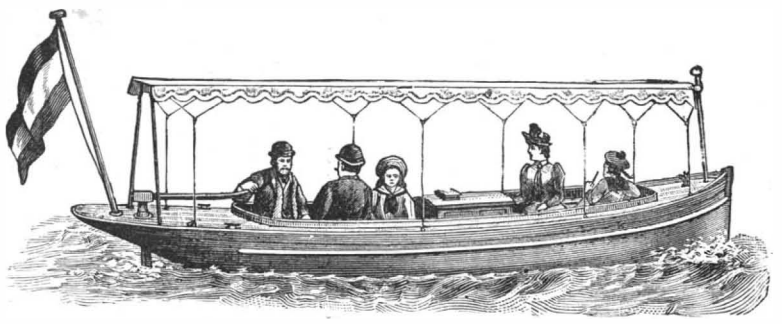
These engines are to be used for any purpose and in any place where a gas engine is applicable, also in places where gas is not obtainable and where steam is not allowable. Besides the economy in fuel, there is also great economy in attendance, as the engine requires no special engineer, and it is self-regulating in all respects, so that it runs for hours without any attention whatever.

Besides the uses already enumerated, it is specially applicable to small electric light plants, for pumping water and for driving the machinery used in small industries. It has also been applied to tramways, being put up in the form of a small dummy locomotive.

Further information may be obtained by addressing J. M. Grob & Co., manufacturers, Leipzig-Eutritzsch, Germany.

The Proposed Lighthouse off Cape Hatteras.

The Lighthouse Board of the Treasury Department has not given up the project of erecting a lighthouse on the outer Diamond Shoal, off Cape Hatteras. The shifting sands of the ocean bottom at this point, combined with the frequency and the violence of storms and the difficulty of getting material to the ground, conspire to make the erection of a light house there more difficult than any undertaking of the kind that has ever been attempted in the world before. Since the firm of Anderson & Barr, after their unsuccessful attempt to sink a foundation caisson for the proposed structure, gave up their contract, the engineer officers of the Lighthouse Board have been studying very carefully the problem of how to combat the forces of nature which expend all their fury on the wide expanse of shallow sea that stretches out from Hatteras. When the attempt was made to sink the caisson last year, it was taken for granted by the contractors that the most favorable months for work on the shoal were the summer months. The board has been looking into this and has found that the most unfavorable months in the entire year are from the end of May until the end of September. A graphic chart has been prepared from the records of the Hatteras weather bureau station for the twelve years that it has been in existence, showing the percentage of wind from all points of the compass for each month in the year. The most unfavorable wind is that from the southwest, which is the prevailing wind in the summer months, reaching as high as thirty-two per cent of the whole during July and falling to eleven per cent in October. The most favorable wind is the off-shore wind from the northwest, which prevails only three per cent of the time during the summer months of May, June, July and August, and rises to nearly seventeen per cent in October. There is never much calm weather in that locality, that is, there is not much time when there is not a perceptible wind blowing, but the percentage of calm is slightly greater in November than at any other time of the year. A careful study of the chart has led the Lighthouse Board officials to conclude that the best time to begin work on the shoal is during the mild Indian-summer weather of the late fall, when there is more probability than at any other time of the year that they will have light off-shore winds for a sufficient time to enable them to get a foundation caisson down and get the structure far enough advanced to withstand the buffeting of a severe storm.—*Baltimore Sun.*



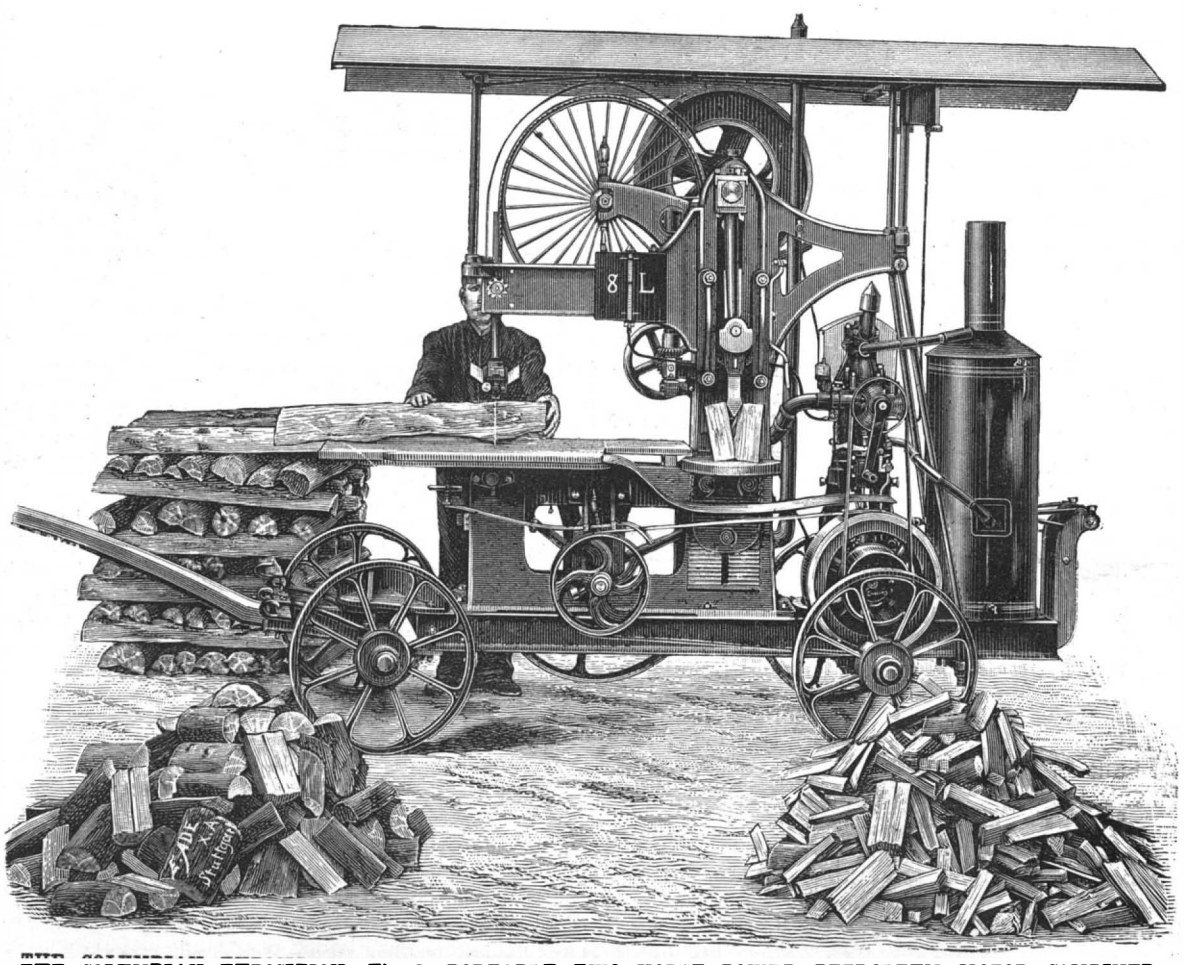
THE COLUMBIAN EXPOSITION.—Fig. 3.—BOAT PROPELLED BY A FOUR HORSE POWER PETROLEUM MOTOR.

Utility of Celestial Investigation.

Sir Robert Ball, in his "Story of the Heavens," says:

"It may be asked, what is the advantage of devoting so much time and labor to a celestial phenomenon like the transit of Venus, which has so little bearing on practical affairs? What does it matter whether the sun be 95,000,000 miles off, or whether it be only 93,000,000 miles, or any other distance? We must admit at once that the inquiry has but a slender bearing on matters of practical utility. No doubt a fanciful person might contend that to compute our nautical almanacs with perfect accuracy we require a precise knowledge of the distance of the sun. Our vast commerce depends on skillful navigation, and one factor necessary for success is the reliability of the 'Nautical Almanac.' The increased perfection of the almanac must, therefore, have some relation to increased perfection in navigation. Now, as good authorities tell us that in running for a harbor on a tempestuous night or in other critical emergencies, even a yard of searoom is often of great consequence, so it may conceivably happen that to the infinitesimal influence of the transit of Venus on the 'Nautical Almanac' is due the safety of a gallant vessel.

"But the time, the labor, and the money expended in observing the transit of Venus are really to be defended on quite different grounds. We see in it a fruitful source of information. It tells us the distance of the sun, which is the foundation of all the great measurements of the universe. It gratifies the intellectual curiosity of man by a view of the true dimensions of the majestic solar system, in which the earth is seen to play a dignified, though still subordinate, part; and it leads us to the conception of the stupendous scale on which the heavens are constructed."



THE COLUMBIAN EXPOSITION.—Fig. 2.—PORTABLE TWO HORSE POWER PETROLEUM MOTOR COMBINED WITH WOOD SAWING AND SPLITTING MACHINE.

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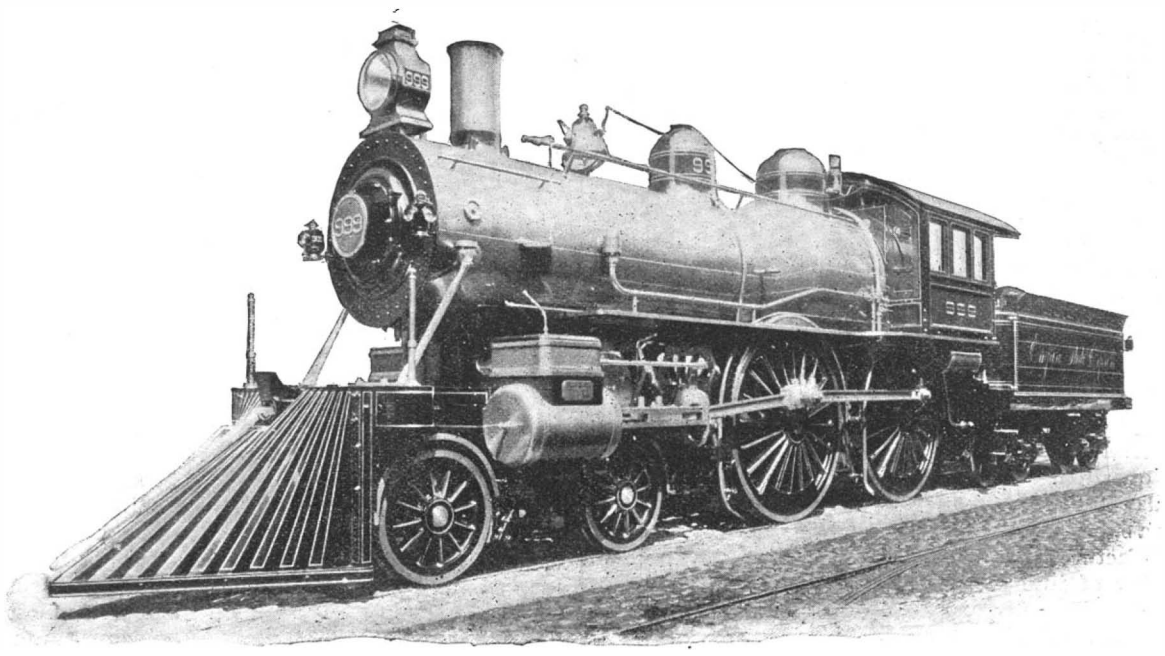
NO. 999.

Of the many locomotives at the World's Columbian Exhibition, English, French, American, the towering form of No. 999 is particularly attractive by reason of the great exploit made therewith on the 10th of May last, when it was run at the wonderful rate of 112 miles per hour between Batavia and Buffalo.

We here give a photo-engraving of this remarkable machine. For the more full details of dimensions and particulars reference is made to the SCIENTIFIC AMERICAN of May 13 last, in which another engraving also appears. The machine weighs 124,000 pounds. There are four drivers. The cylinders are 19 inch diameter and 24 inch stroke. Built at the shops of the New York Central & Hudson River Railway, West Albany, New York.



THE WORLD'S COLUMBIAN EXPOSITION—THE FAMOUS 999.

Presence of Mind in Applying an Antidote.

An instance of rare presence of mind attended by success in the use of an antidote to poisoning occurred recently at Sag Harbor, N. Y.

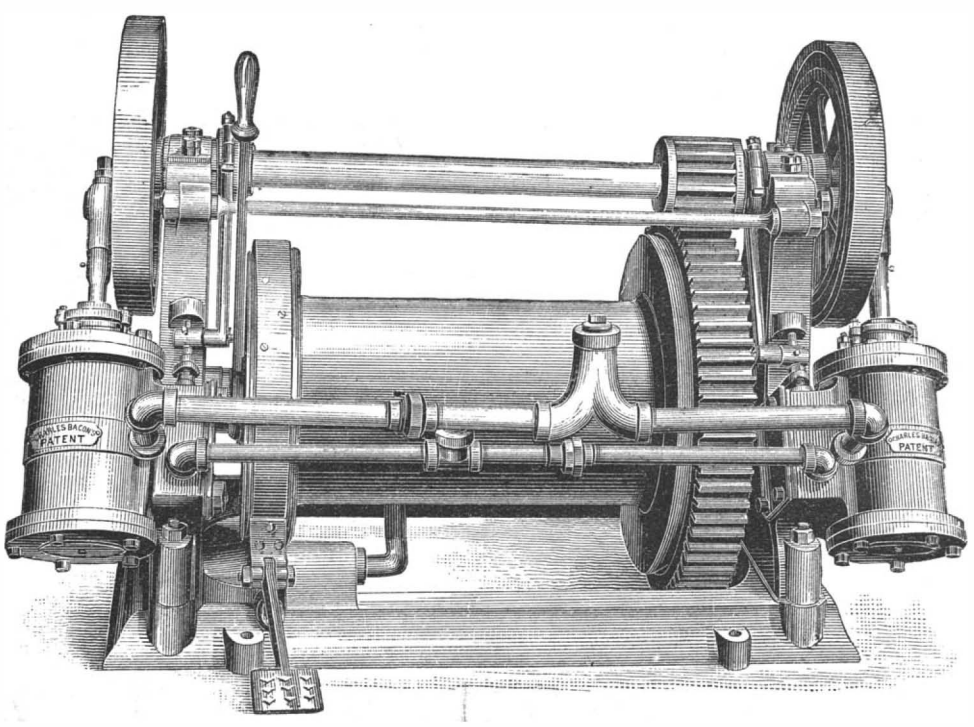
Flora Sterling, the five-year-old daughter of Dr. Sterling, while playing about the house found a bottle which had formerly contained citrate of magnesia and still bore the label. The child put it up to her lips and took a long swallow.

With a scream she dropped the bottle, and began to clutch her little throat in an agony of pain. Her father, who had heard her screams, found that what the little one had taken for citrate of magnesia was oxalic acid. Seeing that not a moment was to be lost, if he wished to save the child's life, the doctor looked about for an alkaline antidote.

Seizing his penknife the doctor sprang to the white-washed wall and scraped some of the lime into his hand. This he threw into the glass partly filled with water, and poured the mixture down the almost dying child's throat. The antidote took effect at once. The intense pain caused by the burning acid was alleviated, and soothing, mucilaginous drinks to cool her blistered mouth and throat did the rest.

HOISTING AND WINDING ENGINES.

The accompanying illustration, representing Bacon's double cylinder "special" hoisting engine, is from the catalogue of Messrs. Copeland & Bacon, well-known builders of mining machinery and hoisting and winding engines, 85 Liberty Street, New York. The drum is driven by means of a V friction on its end, and the lowering of the load is controlled by a foot brake. An engine with 6½ inch cylinders, and occupying a floor space of but 3 by 4½ feet, will hoist 2,500 pounds 100 feet per minute. These engines are especially recommended for inside working of mines, steam lighters, coal yards, ice companies and other light hoisting.



BACON'S DOUBLE CYLINDER HOISTING ENGINE.

Welding the Ends of Railroad Rails.

Tests have been made at Johnstown, Pa., it is said with great success, of an apparatus designed to weld the track rails together as they are laid in the roadbed, in place of fastening them with fish plates, bolts, chains, etc. The machine which produces the welding resembles somewhat a car, but is much more massive than the ordinary electric car. The current is taken from an overhead trolley wire. Inside the car is what is known as a "motor dynamo," which transforms and changes the direct current into a current of the desired kind for the electric welding process. A big crane of special construction extends through the open end of the car, and carries a peculiar apparatus, which is the welder proper. The interior of the car is lined with water tanks, which provide hydraulic motor power for some of the adjustments, and a circulation of water for cooling the copper contacts which are used in the welding. At various points are independent electric motors, which operate emery grinders for cleaning off the rail preparatory to the welding.

The machine was stopped over a joint, where the ends of two rails rested on the same sleeper, and after the necessary connections were made a powerful electric current was turned on. In less than a minute the rails at the ends began to change color, and inside of three minutes the metal was raised to a white heat. Then the ends of the rails were brought together under pressure and a perfect weld was made in all cases where the conditions were favorable.

The advantages which will arise from the success of this machine are that as the rails wear off speedily at the joints, the life of the rail is increased; the increase of the life of the motors attached to each car, in the running of electric street cars, the comfort of the passengers, by relief from the constant jar now experienced in passing over the joints, the great decrease in the noise of the electric cars, and—what may be considered the greatest advantage—the fact that these continuous rails will carry back the current to the dynamo, so that the wastage of electricity, which has in many cases seriously affected the gas and water pipes, will be prevented.

An Accident on a Chicago Cable Road.

Recently Chicago people had an illustration of the dangers of running cable roads in narrow and crowded streets. The down-town loop of the Northside cable road commences at the mouth of the La Salle Street tunnel, runs south three blocks to Monroe Street, east two blocks to Dearborn Street, north four blocks to Randolph Street, and west two blocks to the mouth of the tunnel. A cable train consisting of three large passenger cars and one large grip came out of the tunnel, and the gripman attempted to stop just south of Randolph. The grip refused to let go the cable, and the train could not be stopped. This cable runs at about six miles an hour, and, in spite of the efforts of the gripman to stop the train, it ran all the way around the loop and down into the tunnel at the speed of the cable, causing considerable damage on the trip. Horse cars were overturned and vehicles damaged, and the train was only finally stopped by a collision with the preceding train when part way down the grade into the tunnel. Several persons were injured in the collision. On an examination it was found that one of the strands of the cable had become loosened and had caught in the grip. At the collision the grip was wrenched from the car and passed under the preceding trains and damaged several grips. The result was that the whole loop was blocked until the next morning. As soon as it was discovered that the train could not be stopped, some of the employes of the road ran ahead of the train warning people to get out of the way; and had it not been that the accident occurred when the streets were comparatively free from traffic, the damage would have been much greater.

The seriousness of this accident can hardly be realized until one sees an unmanageable train of four cars running through the streets of a crowded city. Most of the streets of Chicago are very wide, being from 60 to 80 feet between curb lines, with room for a double-track railroad, with space sufficient for two trains abreast on each side between the tracks and the curb lines. Had there been a blockade in the street with teams going in both directions, the loss of life would have been considerable. The possibility of such accidents is one of the defects of the cable system, and although there have been many attempts to design a grip that will not get tangled up with a loose strand, yet cable men assert that nothing has been designed that will prevent such accidents with any certainty. If such an accident as this should take place in the vicinity of the World's Fair grounds during the coming summer, the cable railroads, on which many people will have to rely for transportation to the World's Fair grounds, would be blocked for hours. On the section of the cable road nearest the Fair grounds the cable travels at a speed of 13·8 miles an hour. The increased speed would make an accident of this kind all the more dangerous. One of the advantages of a cable road in crowded streets lies in the fact that the cable has a fixed speed and it is impossible for a car to run faster than the cable; hence there is no danger of racing in the streets, such is common with the electric railroad in Boston; but the possibility of such an accident as a cable getting entangled in a grip offsets considerably the advantage obtained by a fixed maximum speed.

Chicago people are accustomed to the most dangerous conditions of street transportation existing in the world. This is apparent from the fact that trains of four cars each, moving quite rapidly, pass each other going in opposite directions at intervals of about 15 to 20 seconds, giving just time for teams and foot passengers to dodge the trains. Crossing the cable lines are numerous street car lines in the down-town section, all of which render the heart of the city a place to be avoided by all but active people. The city authorities realize this, and have detailed policemen to watch the crossing points; but it is needless to say that one policeman has but little power over traffic so important and heavy as that just described. Practically in Chicago, the cable roads have the right of way, and the public feel that they must look out for themselves. In no other city in the world is it customary to run four-car trains in opposite directions through the principal streets; and if it were not for the fact that the cable companies give to their cables the most rigid inspection every night after the cars have stopped running at 12 o'clock, the troubles would be greater than they are. The inspection of the cable is much more thorough than the inspection of the grips; but a broken grip will only cause a delay of an hour or an hour and a half, while a broken or stranded cable may cause a delay of from four to six hours. If such an accident as this one in Chicago should occur on Broadway, New York, where there is little room for teams, the result would be very expensive for the cable company, and would, very likely, cause loss of life.—*Railroad Gazette.*

THE Languedoc ship canal, in France, by a short passage of 148 miles, saves a sea voyage of 2,000 miles by the Straits of Gibraltar.

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The Industrial Uses of Sodium Silicate.

About two months since we gave in these columns an outline of the manufacture of sodium silicate. We now propose to deal with some of the ways in which this article may be applied in use. Besides the principal use of silicate of soda in the manufacture of cheap soaps, there are many purposes for which its employment is found to be advantageous or even indispensable. It may be of interest to briefly enumerate a few of the more important ones; some are still kept secret by manufacturers. Silicate of soda, combining the properties of caustic alkali and soap, is well adapted to be used either by itself or in connection with other detergent materials for cleansing all kinds of articles where the action of caustic soda is too keen, or that of carbonate of soda or soap not strong enough. Thus it is found to be extremely useful in cleaning greasy materials. Several of the Continental railway companies, for instance, are able, by the use of silicate of soda, to recover their dirty cotton waste no less than about twelve times, while formerly (when caustic soda was employed) this could only be done two or three times. This fact proves that the strength of vegetable fiber is not impaired in any material degree by treatment with the agent in question.

Very favorable results have also been obtained with silicate of soda as a substitute for caustic soda in the manufacture of paper, especially in the bleaching of jute and hemp waste; it has furthermore been successfully employed in connection with the process of sizing and waterproofing paper (wall papers, etc.), as well as a substitute for china clay.

This silicate is also a fixing agent for alumina and other mordants on cotton, while it is said to be unequaled as a sizing for cotton thread in cotton mills for preparing stock for the loom.

Its use for rendering textile fabrics incombustible is well known, and has extended over a period of nearly thirty years.

Large quantities are consumed in the manufacture of artificial stones, of enamels, and paints. The so-called silicated paints contain silicate of soda as a principal ingredient.

It is found useful in building construction for rendering timber fireproof and walls waterproof or air-tight. Its uses in chemical works are numerous. Thus it is employed for soaking bricks when it is desirable to prevent diffusion, for painting steam pipe coverings, and thereby dispensing with canvas covering.

Asbestos mixed with silicate of soda forms an excellent non-conducting material, especially adapted for jacketed pans, retorts, etc.

It may be used by itself or in connection with other materials as a cement for stone, glass, porcelain, marble, etc., and for attaching labels to metal surfaces. Certain kinds of cements owe their hardening properties to the presence of silicate of soda. Sellar's cement, for example, consists nearly entirely of barium sulphate and sodium silicate.

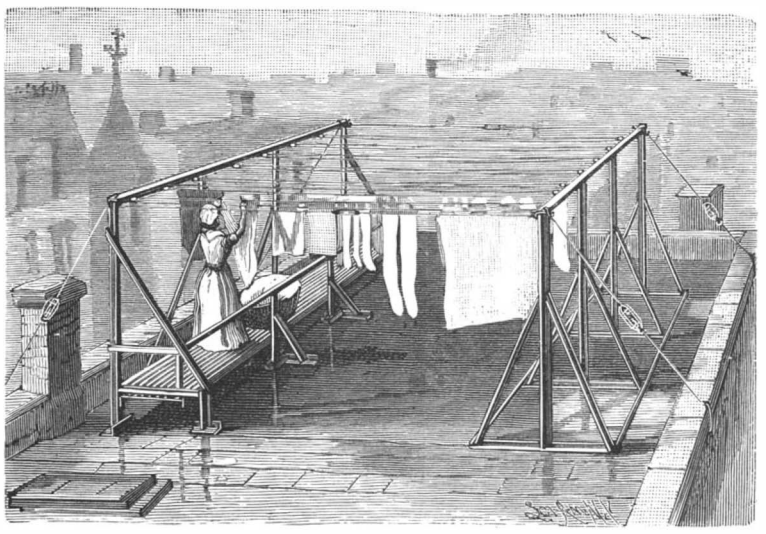
Silicate of soda is the only material from which pure hydrated silica may be prepared, such as is required in some processes for bleaching oils. For this hydrated silica probably many uses will be found as the result of further experiments.—*Chem. Tr. Jour.*

New Double Deck Screw Ferry Boats.

Two new screw ferry boats have been built by the Harlan & Hollingsworth Company, of Wilmington, Del., for the Central Railroad of New Jersey, to ply on the Hudson River between New York and Jersey City. The new boats are called the Easton and Mauch Chunk. The boats are of the same dimensions, namely, 158 feet long, 32 feet moulded beam and 54 feet beam over guards, 14 feet 4 inches depth of hold, and 9 feet draught. Plates are steel, frames iron. Their motive power consists of two 7 foot propeller wheels, one in each end, driven by two compound engines, arranged one forward of the other and working on a continuous shaft, cranks being placed at right angles. The high pressure cylinders are 16 inches diameter, low pressure 30 inches, with 22 inches stroke. There are two steel boilers of the straight through type, 19 feet long and 8 feet diameter; each boiler has two corrugated steel furnaces, and is built for working pressure of 100 pounds steam, independent feed and circulating pumps. The lower saloons, 100 feet long, are furnished with oak, in panels, with French plate glass mirrors every 10 feet. The upper saloon, finished with butternut panels, is 80 feet long, and is reached by two easy stairways leading from the lower cabins.

A ROOF CLOTHES-DRYING DEVICE.

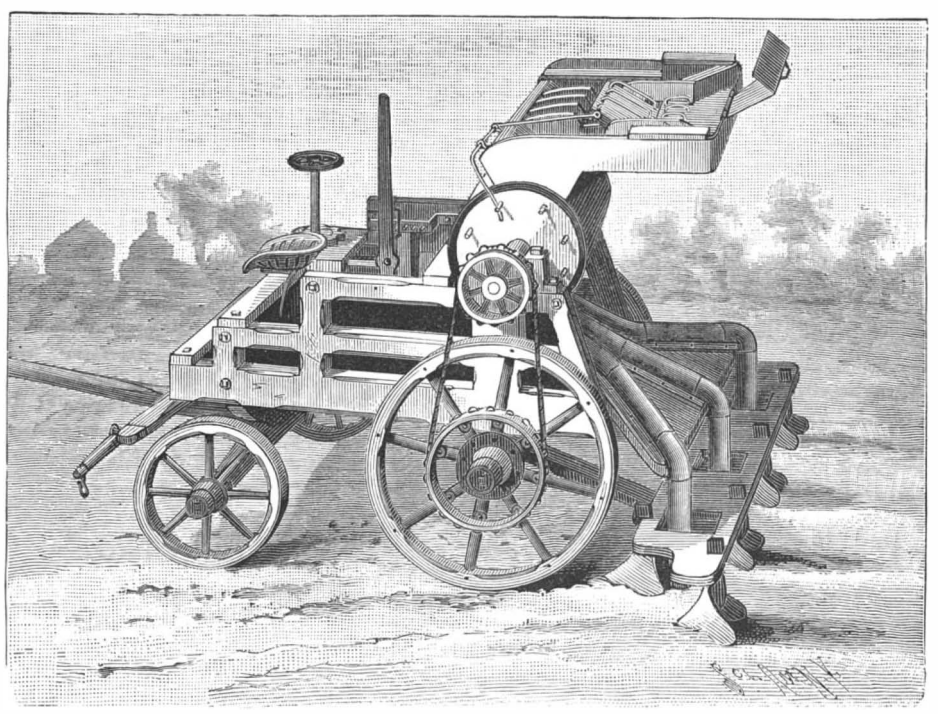
A frame for supporting clothes lines on the roofs of houses, one of inexpensive construction, conveniently adjustable, and which will be strongly held in place on the roof without the use of nails or screws, is shown in the engraving, and has been patented by Mr. Leo Oppenheimer, of No. 325 East Tenth Street, New York City. The side frames supporting the lines may be of any suitable construction, and they are adjusted toward or from each other, according to the tautness or slack of the lines, by means of cross rods connecting the ends of the top rails, each of the rods having a turnbuckle, by means of which the rods may be readily lengthened or shortened. Similar rods also extend downwardly and outwardly from the ends of the rails to hooks on the edge of the coping or other fastening on the top of the wall of the building, these rods likewise having turnbuckles, for lengthening and shortening the rods to adjust the frames and hold them securely down on the roof. By means of this improvement the frames may be readily held in the desired position, and the roof is not injured by perforations likely to cause leakage.



OPPENHEIMER'S ROOF DRYING FRAME.

AN IMPROVED POTATO PLANTER.

In the machine shown in the illustration, the seed potatoes are automatically fed from a hopper to a feed device, thence to pockets and chutes by which they are conducted to the furrows, which are made in the ground as the machine advances, and covered after the potatoes have been dropped in them. The improvement has been patented by Mr. Nathan Sturdy, of No. 4834 Halstead Street, Chicago, Ill. Within a casing surmounted by a hopper is a drum, preferably of sheet metal, upon a shaft revolved by the movement of one of the axles, the drum having on one head a series of pins, and containing a corresponding number of chambers in its peripheral surface. Each drum chamber is also divided into three pockets, and the hopper is divided into corresponding registering compartments, each partition having at its rear upper edge a recess adapted to receive a feed device, consisting of a pivoted table adapted to receive the seed potatoes. The table has skeleton transverse partitions which allow the escape of dirt, and are close enough together to insure the delivery of the potatoes endwise through the hopper. Upon a platform at the rear of the hopper are partitions forming a chamber in which the potatoes to be planted are placed, the platform being somewhat inclined and having ribs guiding the potatoes in their delivery to the feed table. The latter is rocked, as the drum is revolved on the movement of the machine, by a lever extending within the path of the pins on the drum head, the feed table when in one position receiving the potatoes, and as it rocks delivering them to the pockets of the drum, from which they are discharged through the chutes supported upon the rear platform to the furrows. The plows and covering blades are supported upon a head having near each end a forwardly extending tongue pivotally secured upon the rear axle. The tongues are connected at their forward ends by a cross-bar, connected by a link to a bell crank lever, the other arm of the lever being connected with a rack engaged by a pinion on a shaft having a hand wheel in convenient reach of the driver. By means of this wheel, or by an upright hand lever, the covering blades and plows may be raised and lowered as desired, the machine when in operation planting three rows of potatoes at the same time.



STURDY'S POTATO PLANTER.

Are Americans a Practical People?

The notion prevails in this country that we are a very practical people. We take credit to ourselves for being sensible, shrewd, and at least mindful of our own interests. This quality gets a harsher name from our foreign critics. They say that we are materialistic, grasping, and in fact sordid, as the thing we most care for is money, and that which we are most alive about is our material interests. They admit that we are "smart," but say that we are mentally commonplace and unimaginative. The critics are mistaken, and our own estimate of ourselves is more complacent than correct. We are a very imaginative people, and in many ways the most unpractical. The old stage conception of Uncle Sam as a good-natured rustic sitting in a rocking chair, whittling, was not altogether out of the way. Whittling is not a remunerative occupation, as a rule, although this quaint waiter on Providence, who seemed to imagine that if he sat at ease, all good things would in the course of time pass his way, occasionally did whittle out an invention that would save him from labor. He answered the gibes of his critics by pointing out the fact that the chair he sat in was a self-rocker—a little invention of his own. He was a man of vague dreams and imaginations.

No; brought to the test in the commercial struggle of the modern world for supremacy, the American is not practical. In rivalry with other active nations he shows himself a bungler, and lacking in practical wisdom and foresight. An inventor, yes; but lacking practical shrewdness. He is very ingenious. He has gone on doubling in the past few years the great world staples of corn, cotton, and iron, and he seems confidently to expect that Providence will market them for him; especially as he has cheapened the cost of all these products, it would only be fair for Providence to attend to the selling part. He knows that one per cent of the arable land in the cotton States will produce all the cotton the world can use, and he knows that the product of cotton and iron and grain increases in an enormously greater ratio than the population, and yet he neglects many of the most obvious means to profit by this bounty of nature and of his situation. He looks on and brags about his greatness, while his industrial and commercial rivals occupy the markets of the world. Now that he is in rivalry with them for a fair share in so plain a prize, his conduct shows him to be the most unpractical of men.—*Charles Dudley Warner, in Harper's Magazine for April.*

Ruthenium Red.

The color discovered by M. Joly in his researches on the ruthenium ammoniacal compounds rivals the most brilliant coal tar pigments by its tinctorial intensity. The author has observed that ruthenium red is the best reagent for the pectic compounds, which are always associated with cellulose in young tissues and in old tissues which have not been modified by foreign matters. It is the only reagent for the transformation products of the pectic compounds, *i. e.*, the majority of gums and mucilages.—*Louis Mangin.*

. AN omnibus has been started in Glasgow furnished with pneumatic tires, which are protected from injury by sharp stones or glass by canvas and wire-wove netting. There is no jolting or jarring, and the noise is reduced to a minimum.

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POSITION OF THE PLANETS IN JUNE.

SATURN

is evening star. He holds the place of honor on the June records, but when the month closes will be compelled to retire into comparative obscurity, for more brilliant rivals will enter the field. Saturn is in quadrature with the sun on the 27th, at 3 h. 2 m. P. M., being 90° east, and is then on the meridian about sunset, and sets at midnight. He will be found in the west after quadrature, and is still in good position for observation. This interesting planet, after a long season of retrograding or moving westward, becomes stationary on the 9th, and then turns his course eastward or in direct motion, continuing to move in this direction until the end of the year. He has receded from Gamma Virginis since the time of their conjunction on April 8th, when planet and star were but 6′ apart, but after the 9th will approach the star, coming again in conjunction on August 9th, when he will pass by his neighbor and not be found again in its vicinity for thirty years. The star apparently keeps the same place in the sky, the planet makes the circuit of the zodiac before they meet.

The moon, one day after the first quarter, is in conjunction with Saturn on the 21st, at 10 h. 16 m. A. M., being 48′ south. The conjunction, occurring in the day time, is invisible. The resulting occultation is visible only in the southern hemisphere.

The right ascension of Saturn on the 1st is 12 h. 26 m., his declination is 0° 3′ south, his diameter is 17″.2, and he is in the constellation Virgo.

Saturn sets on the 1st at 1 h. 43 m. A. M. On the 30th he sets at 11 h. 46 m. P. M.

MERCURY

is morning star until the 4th, and then evening star. He is a busy member of the planetary brotherhood during the month, although the incidents in which he plays a part are of the class that are seen only in the mind's eye. The swift-footed planet is in superior conjunction with the sun on the 4th, at 11 h. 30 m. P. M., when he joins the ranks of the evening stars. He is in conjunction with Neptune on the 3d, at 11 h. 23 m. A. M., being 2° 1′ north. He is in conjunction with Venus on the 14th, at 9 h. 39 m. P. M., being 0° 59′ north. He is in conjunction with Mars on the 27th, at 11 h. 19 m. A. M., being 0° 25′ north.

The moon, on the day of her change, is in conjunction with Mercury on the 14th, at 8 h. 16 m. P. M., being 2° 53′ north. The conjunction takes place soon after sunset.

The right ascension of Mercury on the 1st is 4 h. 21 m., his declination is 21° 40′ north, his diameter is 5″.0, and he is in the constellation Taurus.

Mercury rises on the 1st at 8 h. 15 m. A. M. On the 30th he sets at 8 h. 58 m. P. M.

NEPTUNE

is evening star for about eight hours and then morning star. He is in conjunction with the sun on the 1st, at 8 h. 26 m. A. M., making his appearance after that time on the western side of the sun. Neptune and Mercury are almost as close to the sun as possible during the early part of the month. Neptune is in conjunction on the 1st, and when only a two-days-old morning star encounters Mercury, who then takes his turn, being in superior conjunction with the sun on the 4th. Venus and Jupiter are not far away, having lately emerged from their eclipse in the sunbeams. The sun, after the 4th, has Mercury and Venus on his eastern side and Neptune and Jupiter on his western, four planets and the great day star being in near neighborhood. Miss Clerke says that "the stars are gregarious." It seems oftentimes as if the same term might be applied to the planets.

The moon, the day before her change, is in conjunction with Neptune on the 13th, at 7 h. 9 m. A. M., being 5° 7′ north.

The right ascension of Neptune on the 1st is 4 h. 38 m., his declination is 20° 38′ north, his diameter is 2″.5, and he is in the constellation Taurus.

Neptune rises on the 1st at 4 h. 45 m. A. M. On the 30th he rises at 2 h. 47 m. A. M.

JUPITER

is morning star. He is now far enough west of the sun to be easily visible, rising on the 1st 1 h. 8 m. before the sun, 2 h. 14 m. on the 19th, and 2 h. 48 m. on the 30th. The prince of planets makes a fine appearance in the morning sky, and will reward the enterprise of observers who rise early enough to behold the Star in the East, who has but one rival in size and brilliancy in the star-studded firmament. The satellites, invisible from April 1st to May 25th, on account of the planet's close approach to the sun, may now be seen. Jupiter is moving eastward or in direct motion and continues this course until some time in September. His northern declination is increasing, his diameter is increasing, and he will soon be the chief object of interest on starlit nights in the small hours of the morning.

The moon, three days before her change, is in conjunction with Jupiter on the 11th at 6 h. 41 m. P. M., being 2° 57′ north.

The right ascension of Jupiter on the 1st is 2 h. 55 m., his declination is 15° 41′ north, his diameter is 31″.9, and he is in the constellation Aries.

Jupiter rises on the 1st at 3 h. 14 m. A. M. On the 30th he rises at 1 h. 39 m. A. M.

VENUS

is evening star. There is little to be said about her while she is so close to the sun, but next month she will speak for herself. Observers who wish to obtain the earliest view of her presence should scan closely the western sky on the last of the month a quarter or a half hour after sunset, when the beautiful star may be seen for a short time near the sunset point.

The moon is in conjunction with Venus on the day of her change on the 14th, at 8 h. 21 m. P. M., being 3° 52′ north.

The right ascension of Venus on the 1st is 5 h. 14 m., her declination is 23° 55′ north, her diameter is 10″.0, and she is in the constellation Taurus.

Venus sets on the 1st at 7 h. 58 m. P. M. On the 30th she sets at 8 h. 31 m. P. M.

URANUS

is evening star. He is still retrograding, but moves at so slow a pace that his position has changed little from that of last month. He may be found between Alpha Librae on the east and Lambda Virginis on the west, shining as a star of the sixth magnitude. The surer way to find the planet is with the aid of a small telescope, which will bring him to view as a small disk of a delicate green color.

The moon is in conjunction with Uranus, three days after the first quarter, on the 23d at 11 h. 22 m. P. M., being 1° 40 north. The conjunction is visible with the aid of a telescope or marine glass, for the moon light will put out the light of the small planet, if looked for by the unaided eye.

The right ascension of Uranus on the 1st is 14 h. 21 m., his declination is 13° 33′ south, his diameter is 3″.8, and he is in the constellation Virgo.

Uranus sets on the 1st at 2 h. 49 m. A. M. On the 30th he sets at 0 h. 54 m. A. M.

MARS

is evening star. Although he does not reach conjunction with the sun until September, he is so small and so far away that he has disappeared from view. His diameter is but 40″.0, and he will be looked for in vain by the unaided eye for the rest of the year. His conjunction with Mercury has been alluded to.

The moon, one day after her change, is in conjunction with Mars on the 15th at 7 h. 57 m. P. M., being 3° 54′ north.

The right ascension of Mars on the 1st is 6 h. 52 m., his declination is 24° 6′ north, his diameter is 4″.2, and he is in the constellation Gemini.

Mars sets on the 1st at 9 h. 38 m. P. M. On the 30th he sets at 8 h. 49 m. P. M.

Mercury, Venus, Mars, Saturn and Uranus are evening stars at the close of the month. Jupiter and Neptune are morning stars.

Underground Temperature.

In answer to a question as to the method of taking temperatures of rocks at different depths in mines, a description may be given of that adopted by Charles Forman in determining the temperatures in the Forman shaft some ten years ago. The temperatures were taken from the surface to a depth of 2,300 feet. They were ascertained by drilling holes not less than three feet deep into the rock and inserting into the hole a Negretti & Zambra slow-acting thermometer of the pattern adopted by the Underground Temperature Committee of the British Association and standardized at Kew. These holes were closed with clay and the thermometers were left in for 12 hours, not less than three holes being tried at each point. The following are the depths in feet and the temperatures in degrees Fahrenheit:

Feet.	Deg.	Feet.	Deg.
100	50½	1300	91½
200	55	1400	96½
300	62	1500	101
400	60	1600	103
500	68	1700	104½
600	71½	1800	105½
700	74¾	1900	106
800	76¼	2000	111
900	75	2100	119½
1000	81½	2200	116
1100	84	2300	121
1200	89¼		

It may be stated that more accurate results might have been attained had the holes been filled with water, the thermometers put within a foot of the bottom, the holes then plugged, and the thermometers left for 12 hours. In the dry state the average heat of the rock is not so well ascertained as it is when equalized by the water. However, the results would not differ very greatly. Of course, higher temperatures than this are experienced in certain drifts and close places in a deep mine, but it was the actual temperature of the rocks which was desired. In the record quoted, no mention is made of the varying characters of the rock itself.—*Mining and Scientific Press.*

Correspondence.

Curious Tree Growths.

To the Editor of the Scientific American:

In your issue of May 13 I saw a communication from J. T. Morey. The tree growth illustrated may have been a case of abrasion and the natural result, or it may have been caused by some one who, like myself when a boy, delighted to make trees assume unnatural shapes.

In Guilford, Vt., are two beech trees that have grown into one. About twenty years ago I cut the top from one and made a slit in the other. I then united the two trees.

It proved a successful graft, and when I saw them last fall they were about eight inches through at the base, distance apart about three feet, place of union about seven feet from the ground. Near this tree on the bank of a small stream stood a willow. I trimmed it, cut off the top, bent it over the stream and planted the top of the tree in the opposite bank. It rooted and in summer the stream flows under a beautiful green arch. Another has its branches bent down and planted in a circle about its base. Another was twisted about an old fence rail, and, as the rail has decayed, the tree resembles a giant cork screw. Another tied in a knot has grown so large that it would be no easy matter to untie it. On this same farm is an apple tree whose fruit is a union of the golden sweet and greening, or, in other words, the same apple is part sweet and part sour.

It was produced by grafting the buds of a golden sweet and greening into another tree, and the singular part of it is the sweet part is covered with the yellow skin of the golden sweet, while the sour part, like an Irishman, sticks to its green. H. B. B.

Waterbury, Conn., May 13, 1893.

A Borax Mine.

Nearly all the boracic deposits heretofore discovered have been found in the form of incrustations on the surface of marshlands, of nodules buried beneath the surface or of crystals embedded in the mud at the bottom of shallow lakes. In a few instances these deposits are found interstratified with layers of earth and rock, the entire formation being in a horizontal position, as seen at several points in Death Valley. But only in the Calico district, San Bernardino County, does one of these boracic deposits occur in the form of a regular vein, so uptilted that it requires to be exploited after the manner of a quartz or other ore-bearing lode.

This deposit, the property of the Pacific Coast Borax Company, is located on the southeasterly slope of the Calico mountains, or rather on a northerly spur of that range. This lode, which outcrops at intervals for nearly three miles, has an east and west course and a southerly inclination. The slate walls are inclosed in sandstone, superimposed upon which is a brecciated rock, evidently of volcanic origin. The crude material here consists of that variety of the borate of lime known as Colemanite. It is of a vitreous adamantine luster and exceedingly rich in anhydrous boracic acid. The contents of the fissure are six feet thick, and at a depth of over 200 feet hold this proportion, nearly pure mineral. The deposit has been opened by several shafts standing 100 feet apart, these being connected by drifts and levels. The material being easily broken down, but a small working force is required in the mine. All that is abnormal about this deposit of borax is easily accounted for. Originally, it was, no doubt, deposited at the bottom of a lake, where, later on, great floods brought down a quantity of sediment which covered it up. In course of time this sediment having been converted into rock, the whole was then lifted up by some great convulsion of nature and left standing at its present angle, this movement having been most likely of a seismic character. In the early history of the borax industry the works put up for the manufacture of this salt were of a very rude and primitive style. Owing to the great cost of lumber, this article had to be economized to the utmost, the crystallizing vats and other portions of the plant being left uncovered. But in the hot and desiccated atmosphere that for two-thirds of the year prevails in that region, this was no detriment so long as the workmen could be protected in part, at least, from the rays of the sun, which here strike down with a killing heat the whole day long.—*Mining and Scientific Press.*

A Counterfeit Equal to a Genuine.

Since dollars are coined out of sixty cents' worth of silver, it is no wonder that counterfeiters have turned honest and are getting out dollars containing the same amount of silver as the genuine, and undistinguishable from the mint issue. In former times, when a silver dollar was worth 100 cents, counterfeiters had to use baser metals, which soon led to their detection. But when the government itself gives a fictitious value to its coinage, who is there to deprecate the acts of individuals who issue a dollar of the same value as the government?

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FOCUSING DEVICE FOR TELESCOPES.

BY GEO. M. HOPKINS.

Astronomers, both amateur and professional, who use small telescopes find themselves annoyed by the difficulty of focusing when a light portable stand is used, and especially when medium and high power eye pieces are employed.

The difficulty arises from the trembling of the instrument when the milled focusing head is turned by hand.

In the attempt to surmount this difficulty, many devices suggested themselves, among which were an electric motor with a switch for starting, reversing and stopping, worm gearing and a flexible shaft, hydraulic cylinders, and a pneumatic device.

The electric motor necessitates a battery, which is more than likely to be out of order when needed; the worm gear and flexible shaft could be worked only by a roundabout method; the hydraulic cylinders would corrode and stick after long disuse. As the pneumatic device presented the fewest objections, it was adopted and perfected. The first practical application of it was made to the fine five inch telescope belonging to Mr. A. E. Beach, one of the proprietors of the SCIENTIFIC AMERICAN. It has been found to perfectly answer the purpose for which it was designed.

Fig. 1 shows the device applied to the focusing tube of the telescope. Fig. 2 is an enlarged side elevation, with the milled head removed, and Fig. 3 shows a double bulb arrangement for operating the pneumatic cylinders.

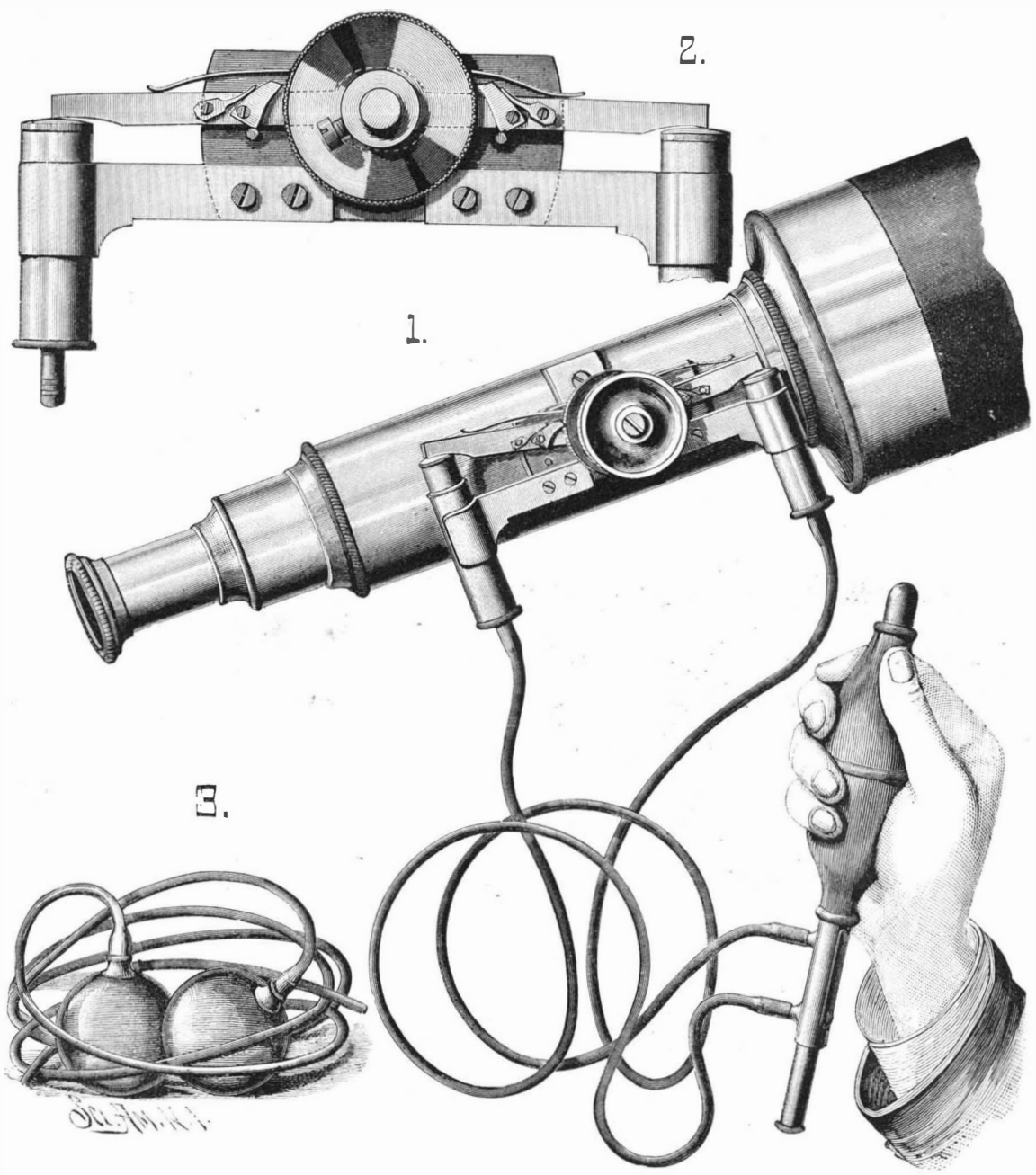
The apparatus is attached to the sleeve in which the spindle of the focusing pinion is journaled, and does not necessitate any change or disfigurement of the instrument, and when not in use it does not interfere with focusing in the usual way. On the sleeve above mentioned is secured the base plate of the apparatus. On a collar projecting from the face of the base plate and concentric with the focusing spindle are fulcrumed two similar levers, one projecting to the right, the other to the left. Both are pressed downwardly by springs attached to the base plate and both carry spring-pressed pawls which may act upon a ratchet mounted on the boss of the milled focusing wheel, but are kept normally out of contact with the ratchet wheel when the apparatus is not in use, by the contact of the lower projecting ends of the pawls with studs projecting from the base plate, as shown in Fig. 2, and when the pawls are in this position the milled focusing wheel may be turned freely in either direction by hand in the usual way.

Pneumatic cylinders are supported under the free ends of the levers by arms attached to the base plate. These cylinders contain pistons, which are capable of acting on the levers.

The pneumatic cylinders are connected by small flexible tubes, with the valve attached to the elastic bulb. The body of the valve passes through the bulb to render the connection rigid. The sliding part of the valve is tubular. It is pressed outwardly by a spiral spring and its motion is limited by a spring-stop attached to the body of the valve. It has a single perforation, which may be made to coincide with either of the branches connected with the flexible tubes. The valve, as shown, is in its normal position. If the elastic bulb is alternately compressed and allowed to expand, the air passing through the lower tube reciprocates the left hand piston. A small upward movement of the lever lifts the pawl from the stud and allows it to engage the ratchet wheel, thus working the pinion and rack in one direction by a step-by-step motion. By forcing in the sliding tube of the valve the air is made to pass through the upper flexible tube, and the right-hand piston is operated and the pinion and rack is moved in the opposite direction.

The focusing may be done as rapidly or as slowly and gradually as may be desired. By substituting the two elastic bulbs, shown in Fig. 3, for the bulb and sliding valve the apparatus is simplified.

The apparatus described may be applied advantageously in other operations, such as focusing cameras, working certain physical instruments at a distance, etc.



PNEUMATIC FOCUSING APPARATUS FOR TELESCOPES.

The Vibrations of Steamers.

An interesting paper on this subject was read lately by Herr Otto Schlick before the Institution of Naval Architects, London.

The apparatus, named pallograph, is founded on the principle of so hanging a weight that, in consequence of its inertia, it takes no part in a given direction in the tremblings and oscillations of the point to which it is suspended. As it appears necessary, for the purposes of the experiments, to take cognizance of the vibrations in both a vertical and a horizontal direction, the apparatus possesses two weights—viz., one which can only move in a vertical and another which can only move in a horizontal direction.

A series of experiments were carried out with the instrument on board the twin screw dispatch vessel Meteor, belonging to the Imperial German navy. The vibrations, both in the vertical and horizontal directions, periodically increase and diminish. The vertical vibrations always attain their maximum when the horizontal are at their smallest, and vice versa. This phenomenon is peculiar to twin screw vessels only, and is explained by the difference in the numbers of revolutions of the two engines, and the reactions of the masses of the moving parts. When, for instance, the relations are such that in the revolutions of both engines the piston of one cylinder of one engine and that of the corresponding cylinder of the other engine are each simultaneously in either the highest or the lowest positions, the greatest number of moving parts of considerable weight of both engines are then moving in the same sense in the vertical direction. Pistons, piston rods, connecting rods, crossheads, and cranks are here taken into account, and the low pressure cylinder, in fact, determines the beat of the vibrations, because its piston is the heaviest. The masses of these parts acting vertically will be added together. The vertical vibrations must, under these circumstances, reach a maximum. The relations governing the vibrations in a horizontal direction are exactly the reverse of the above. The action of the masses of the heaviest moving parts of the engines—viz., the connecting rods and the cranks—neutralize each other, because they are of equal size, and act in opposite directions.

The lateral vibrations registered by the instrument can, only in the rarest cases, be attributed to a horizontal bending of the axis of length of the ship. The stiffness of a vessel in the horizontal direction is so appreciably greater than in the vertical that the period of vibration is too short to permit of a coincidence with the time of a revolution of the engines. The horizontal vibrations shown by the instrument are, therefore, nearly always caused by a torsional vibration. These take place always when the moving parts of the two engines move in the vertical sense, but in opposite directions; when, for instance, the low pressure piston of the starboard engine moves downward at the same moment that the corresponding piston of the port engine moves upward. In this way a reaction pressure upward will be called into existence on the starboard side in the locality of the engine, and a reaction pressure downward on the port side; or, in other words, the transverse section in question of the ship will be forcibly bent over to the port side, and, after half a revolution of the engines, will be again bent over to starboard. In this way the portion of the ship in the neighborhood of the engines will be put into a state of oscillation, which then propagates itself to the parts further forward and aft.

When steaming at full power, the vibrations of the ship were extraordinarily small, which, considering the great engine power and the unusual speed of the ship, must be characterized as a very excellent result.

The cause of vibration, we now know, consists solely in the unison between the number of revolutions of the engines and the number of vibrations of the ship. The older steamers had much smaller dimensions, and the engines, as is well known, ran at much smaller speeds than those of to-day. The smaller the length of the ship the greater is the number, per unit of time, of its vibrations, and the longer the steamer the greater is the corresponding time of its vibrations. There could be no idea of a unison between the number of the vibrations and the number of revolutions of the engines of the older type of steamers, and therefore they did not manifest remarkable vibrations. As progress, however, was made in shipbuilding, the principal dimensions steadily grew, the period of the vibrations became steadily longer, while the necessary greater engine power, which was requisite, compelled the increase of the number of revolutions. We have thus arrived, in the development of shipbuilding, at a period when the time of a vibration and of a revolution of the engines agree, and when for the moment the usual type of ship shows severe vibrations. We find ourselves, therefore, exactly at a critical moment in the development of shipbuilding. But when we go further in this direction and build still larger ships and let the engines run still quicker, these future steamers will either show no vibration or only small ones.

THE new Griffin roller mill, heretofore fully described in the SCIENTIFIC AMERICAN, is being received with great favor by users in a wide variety of pursuits. A miner in Fauquier County, Va., writes that it is "doing more than equal to an ordinary 25 stamp mill in grinding quartz ore, requiring little more than 25 horse power to run mill, rock crusher, amalgamator, and settlers, while the care and attention required to operate it is much less than for the same product by stamps." The mill is made by the Bradley Fertilizer Co., of Boston.

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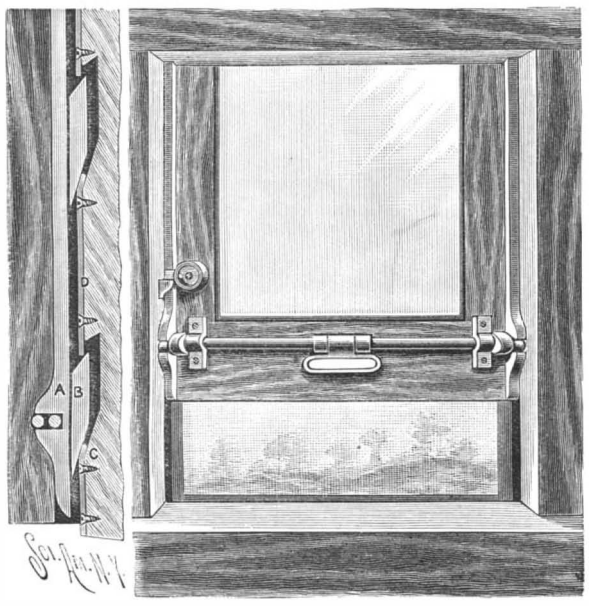
KIRBY'S WINDOW SASH IMPROVEMENTS.

The strong, simple and inexpensive devices shown in the accompanying illustrations are applicable to window sashes of any description, especially to car windows, and are designed to allow the window to



KIRBY'S CAR WINDOW HOLDER AND MANIPULATOR.

slide freely and easily when desired, or to facilitate fixing the sash firmly in such position as may best contribute to the convenience and comfort of those near the window. The improvements form the subject of four patents which have been issued to Mr. S. R. Kirby, of New Brighton, Staten Island, N. Y. By means of the lifting and locking handle provided, shown in one of the illustrations, the window may be easily raised and lowered, and the fastener made to positively and firmly lock the sash. The sash is held behind the ordinary stop beads, between which and the sash is a slight space for the movement of a pair of keeper bars, A, having upwardly projecting blunt teeth, B, the keeper bars lying opposite wear plates, D, on the sash, in which are inclined pockets, C. At the lower ends of the keeper bars are slots forming two opposite lugs, there being held in the slots short studs or cranks projecting from disks on a shaft journaled in keepers on the lower portion of the sash. Centrally on the shaft is a handle, by pressing downward on which the short studs or cranks press downward on the keeper bar, A, causing the teeth, B, to slide downward in the pockets, thus jamming the keeper against the beads and holding the sash firmly in any place at which it happens to be. When the crank is moved in the opposite direction the sash slides freely. If the sash is dropped, the handle and cranks swing downward and assist, with the weight of the keeper bars, to automatically stop the sash and prevent its striking down violently upon the sill. For large windows it is better to have a short crank shaft on one side of the window, instead of extending it entirely across the shaft.

The sash lock device, shown in one of the views, is adapted to lock the lower sash shut and lock the upper sash partially open as desired, yet holding it so it cannot be further opened from the outside. Fig. 1 represents the device in perspective, and Fig. 2 shows it in section. In the parting bead, just above the top of the lower sash, is secured a hanger, supporting the vertical pintle of a swinging bracket which has near its top a flange projected inward to form a bolt adapted to swing into either one of a vertical series of notches in the sill of the upper sash.

The bracket has on its outer face lugs in which is held a vertical screw, bearing upon a wear plate on the rail of the lower sash, the swinging of the bracket throwing the bolt into one of the recesses of the upper sash. The screw is adjustable to make it bear firmly and securely hold the lower sash. Fig. 3 is a sectional view of a securely closing hook-like attachment on the parting rail between the upper and lower sashes. Vertical metal packing leaves are also provided, by which compensation is provided for shrinking or swelling of the wood.

Always Room for Discovery.

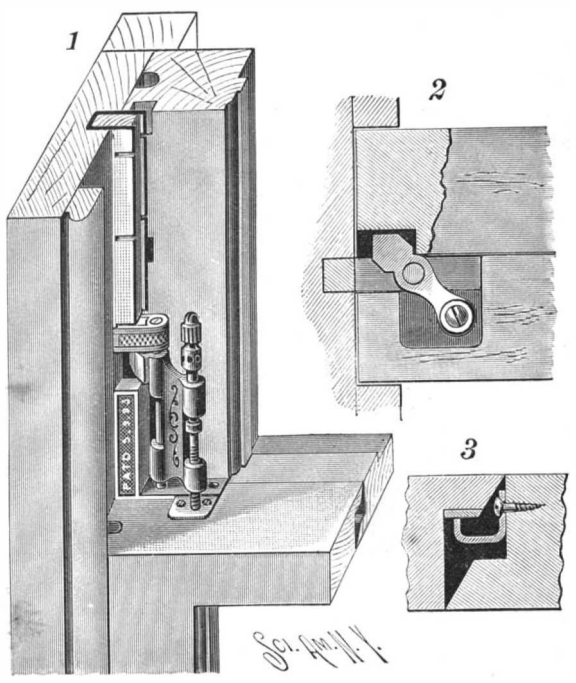
We hear so much about the material progress of the age, our wonderful inventions and the great discoveries that are destined to be of untold benefit to man, that it is well sometimes to take a look through the big end of the field glass and see how little really has been accomplished in comparison with what remains to be done. For in truth we have but scratched the surface of the globe to a very small extent. The north temperate zone alone has begun to be developed, and it is only a beginning—the wastes of Siberia still lying practically uncultivated—while the south temperate zone and the tropics are scarcely touched, with their untold wealth of animal and vegetable products, besides the undoubted mineral resources which they contain.

The new process of cheapening aluminum, one of the largest components of the earth's crust, brings into the field of industrial activities a substance which is destined to work a revolution in mechanics and the applied sciences. Who knows what other uses may be found for the commonest materials lying at our feet? The lesson of it all is that there is always room for discovery and that we are nowhere near the exhaustion point of the earth's resources.—*N. Y. Herald.*

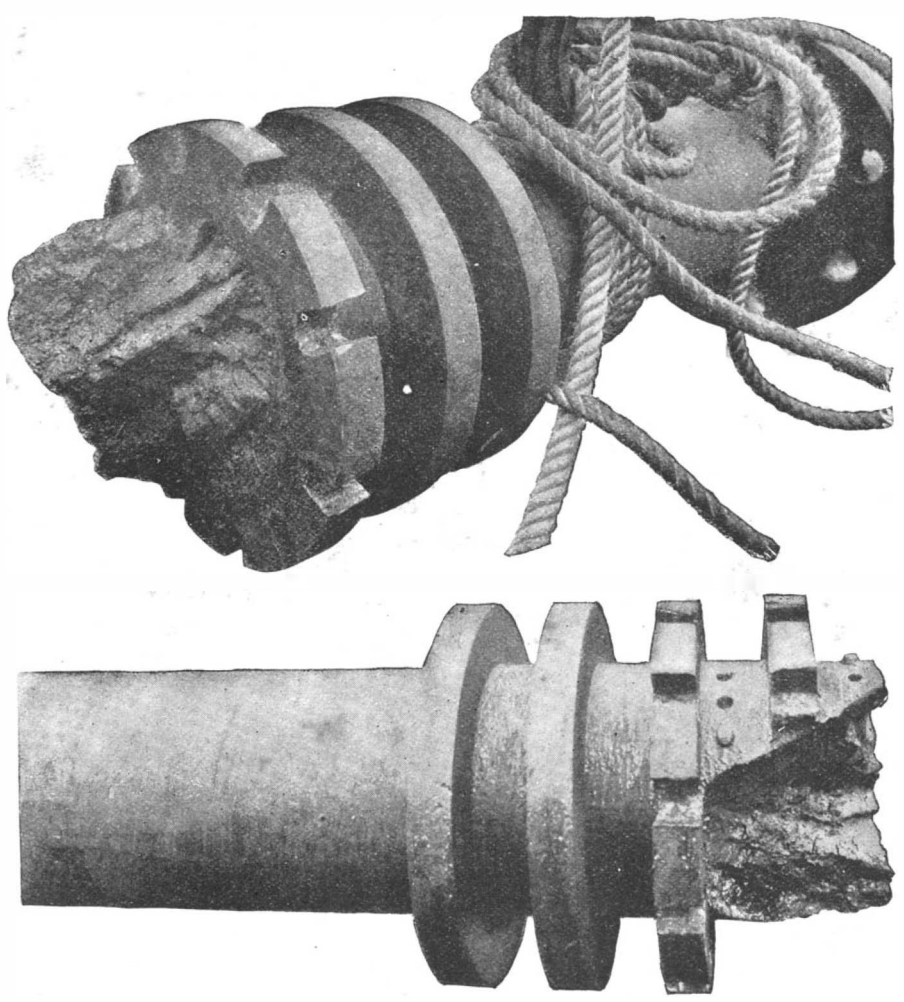
BREAK OF THRUST SHAFT OF STEAMSHIP HECLA.

The steamship Hecla, Capt. Thomsen, arrived at New York April 8, being twelve days overdue. The delay was caused by an accident to her thrust shaft, very similar to that of the Umbria, with the exception that it extended through and between two collars, instead of one, as in the case of the Umbria. The shaft of the Hecla broke twice; the first accident occurred on March 24. The shaft then cracked between the collars, about eleven inches long, but not entirely through. Chief Engineer K. Rafin mended this by bolting belts of ½ inch steel between the collars and also on the sides of the collars; ⅝ inch wire cable was then wrapped around this.

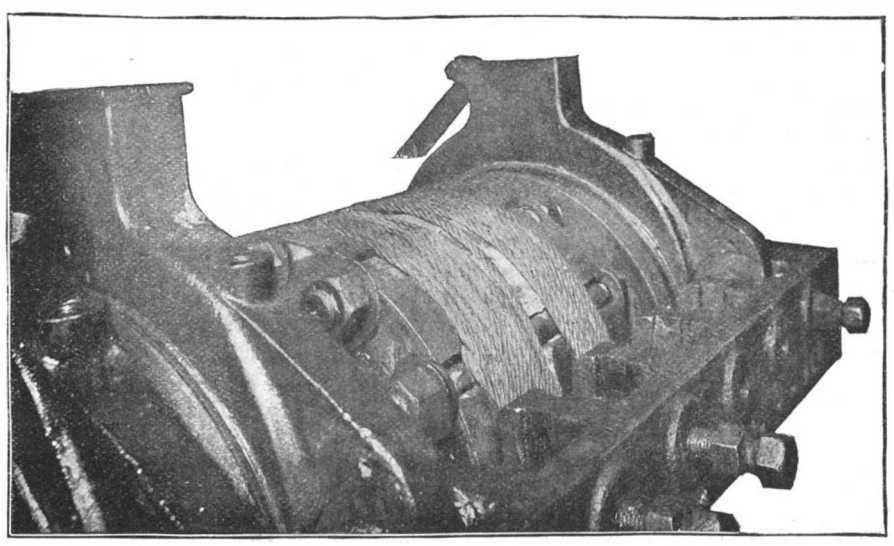
The ship steamed 400 miles with the shaft in this condition, when the weather became severe and the shaft broke a second time—this time completely through. The belts put on the first time were then taken off, and eleven three-inch bolts put through three collars parallel with the shaft. These were screwed up with nuts as tightly as the limited space would allow. Zinc bodies were then cast and put in between the bolts to keep them solid. The wire cable was again wrapped tightly around this flush with the bearings. The ship in the meantime was taken in tow by the National line steamer America and brought to Sandy Hook; from there she steamed under her own power to her dock at Hoboken.



KIRBY'S SASH LOCK AND METALLIC ADJUSTING BEADS.



THE BROKEN SHAFT OF THE HECLA.



THE HECLA'S SHAFT AS REPAIRED AT SEA.

Thomas Duff, of the Dumbarton Iron Works, who surveyed the broken shaft, said the work of repair had been well done and praised Engineer K. Rafin for his work.

Solid Air.

Professor Dewar communicated to the Royal Society at its meeting on Thursday, March 9, a most interesting development of his experiments upon air at very low temperatures. Our readers are already familiar with the fact that he has liquefied air at ordinary atmospheric pressure. He has now succeeded in freezing it into a clear, transparent solid. The precise nature of this solid is at present doubtful, and can be settled only by further research. It may be a jelly of solid nitrogen containing liquid oxygen, much as calves' foot jelly contains water diffused in solid gelatin. Or it may be a true ice of liquid air, in which both oxygen and nitrogen exist in the solid form. The doubt arises from the fact that Professor Dewar has not been able by his utmost efforts to solidify pure oxygen, which, unlike other gases, resists the cold produced by its own evaporation under the air pump. Nitrogen, on the other hand, can be frozen with comparative ease. It has already been proved that in the evaporation of liquid air nitrogen boils off first. Consequently the liquid is continually becoming richer in that constituent which has hitherto resisted solidification. It thus becomes a question whether the cold produced is sufficiently great to solidify oxygen, or whether its mixture with oxygen raises its freezing point, or whether it is not really frozen at all, but merely entangled among the particles of solid nitrogen, like the rose water in cold cream. The result, whatever may be its precise nature, has been attained by use of the most powerful appliances at command—a double set of the vacuum screens already described in our columns, combined with two powerful air pumps. Upon either view of its constitution, the new solid is in the highest degree interesting and hopeful.—*London Times.*

THE coast survey of the United States was begun in 1817.

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RECENT DISCOVERY OF EARLY TEXTS OF THE GOSPELS.

Two ladies, Mrs. Lewis and her sister, Mrs. Gibson, both conversant with Oriental languages, and speaking Arabian and modern Greek fluently, went last year to Mount Sinai, after being thoroughly instructed by Professor Harris in the photographing of handwritings. Although the convent had often been searched for written treasures since Tischendorf's great discovery there—and even by Professor Harris himself only three years ago—the present discovery remained hidden from former investigators. It is a palimpsest manuscript. When Mrs. Lewis first saw it, it was in a dreadful condition, all the leaves sticking together, and being full of dirt. She separated the leaves from one another with the steam from her tea kettle, and photographed the whole text—from three to four hundred pages. It turned out to be a Syrian text of all the four Gospels, closely related to the one known to theologians as Cureton's "Remains of a Very Ancient Recension of the Four Gospels in Syriac," and among all preserved testimonies contains the oldest authenticated texts of the Gospels. Only fragments of the Syrian text have hitherto been known, these being in a single manuscript in the British Museum, and in two leaves of it which came to Berlin. Now, all the four Gospels in this text are nearly complete. Professor Harris himself, on hearing of the discovery, set off for Mount Sinai, and for forty days he and the two ladies sat in the convent deciphering the palimpsest leaves.

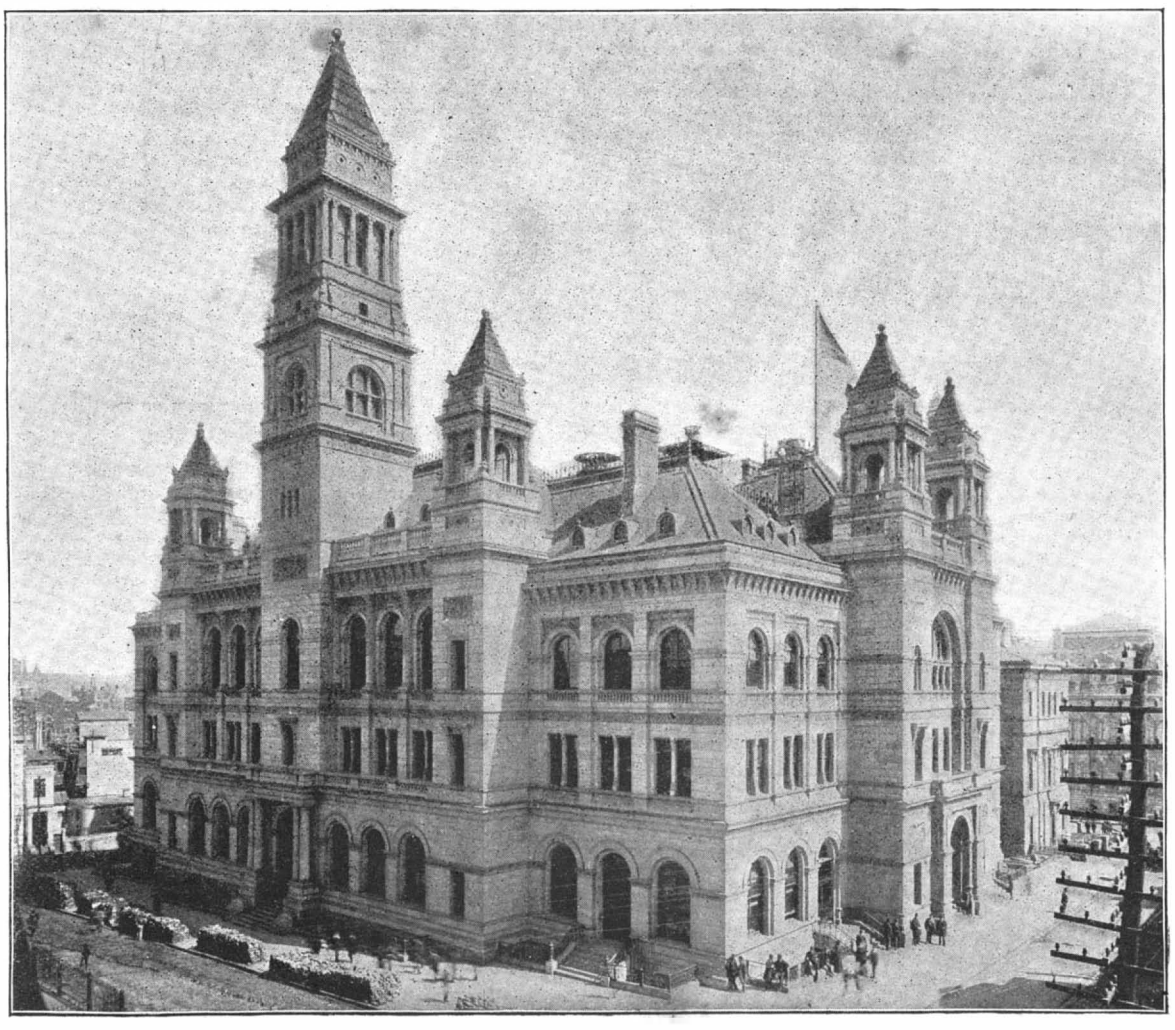
The following letter from Professor J. Rendel Harris, which was published in the *British Weekly* recently, gives further information respecting this important discovery:

"DEAR MR. EDITOR: You asked me, when I was leaving England nearly three months since, to let you have reports of any interesting or important matters in connection with my second visit to Mount Sinai; and it occurs to me that one of the first things that are proper to be done on a return from the desert to civilization is to comply with your very reasonable request and send a message to you, and through you to the readers of the *British Weekly*. We have been in the desert just two months, forty days of which time (it is a canonical number for retirement in the desert) have been spent in the Convent of St. Catharine, on Mount Sinai. We had at first planned a thirty days' retreat, but the work upon which our party was engaged was so important that a prolongation of our stay became imperative, and if it had not been for academic duties most of us would have remained even longer. The fact is that Mount Sinai doesn't often offer such attractions to scholars as it has done this winter, when every facility for study was offered, and when a monumental discovery had been made and only needed to be followed up. This discovery consists in the bringing to light of a very early palimpsest copy of the Old Syriac Gospels, hitherto only known to us in the fragmentary form which critics speak of as the Cureton Gospels. Cureton, however, after whom this early version of the Gospels is named, only found, among the treasures which were brought to the British Museum from the Nitrian desert, scattered leaves of the translation in question. The Sinai palimpsest presents us with almost a complete text of this priceless early rendering of the Gospels. The actual discovery of this MS. was announced by me in the *Academy* and the *Athenæum* some months since, at the request of the finder, Mrs. Lewis, of Cambridge, who visited the Convent of St. Catharine last winter. Mrs Lewis and others who were interested in her discovery wished me to make the announcement for them, but I am sadly afraid that, although carefully worded to avoid misunderstanding, some persons have jumped to the conclusion that I had made the initial discovery myself. This is not the case; the credit of unearthing the lost treasure belongs to Mrs. Lewis, who found the MS. in a deplorable condition, with the leaves stuck together, and in very bad preservation. She separated the compacted leaves by the steam of a tea kettle, and, finding the underwriting of the palimpsest to be a very early text of the Syriac Gospels, she heroically photographed the whole of the MS., and brought the negatives back to Cambridge for decipherment, where her suspicions were confirmed by the reading of portions of the text by Mr. Bensly and Mr. Burkett, who pronounced it to be closely related to the Curetonian version. You can imagine, my dear friend, the work this has made for us. I fancy that Mount Sinai has never before seen three Syriac scholars working at once within its walls, and, which is the droll side of the situation, from a monastic point of view, working under the presidency of a lady. We have had a busy time at the lost text whose traces appear under the more modern writing. From the first rays of the morning sun to the latest light of the evening, hardly a moment has passed when one or other of us has not been busy deciphering the 'Lewis Gospels of Mount Sinai;' but the labor has been well spent, and the results will be of the highest importance."—*Pall Mall Budget.*

MRS. A. S. LEWIS, WHO DISCOVERED THE SYRIAC TEXT OF THE GOSPELS.

THE NEW BALTIMORE POST OFFICE.

The imposing structure shown in the illustration is on the square bounded by Fayette, Lexington, Calvert and North Streets. It is built of marble and is 152 feet in front and 234 feet deep. It affords ample room for the post office business of the principal city of Maryland, and the third story is used for the United States courts. The cost of the building was $2,075,000, of which $553,000 was expended for the site.



THE NEW POST OFFICE AND COURT HOUSE, BALTIMORE.

THERE are eighty miles of tunnels in Great Britain, their total cost exceeding £6,500,000.

The Water Supply of Galveston.

One of the most remarkable systems of water supply in the world is to be found in this city. About a mile north of the city is a valley a thousand feet wide, which surveyors determined to be the location of an underground stream, though the valley itself was dry and under cultivation.

It was suggested that wells might tap this stream and give the city a pure supply of water. The city engineer, a young man from the East, suggested that, in lieu of a reservoir, the hidden stream be dammed, when there would at all times be an inexhaustible supply. He was derided, but, firm in the belief that his theory was right, he obtained an appropriation for an experimental well.

Sinking a large one in the center of the valley, he struck living water at the depth of 30 feet, coming in such quantities that a powerful steam pump could not lower it to any perceptible degree. An appropriation enabled him to carry out his plans, which resulted in obtaining an unlimited quantity of pure water.

Sinking five wells, 200 feet apart, he covered the entire width of the stream. He next tunneled from well to well, making a six-foot excavation the entire distance across the stream. This was enlarged so as to be 6 feet high and 8 feet wide. Then on the lower side he built a substantial stone dam 6 feet high, its foundation being below the bed of the submerged stream, which was clearly defined. The water collected so fast that the central section had to be left until the two wings were completed. When this was done work was begun on the central unfinished portion, two powerful steam pumps being required day and night to keep down the water so that the workmen could complete the structure.

Soundings showed that before the connections were made with the mains leading into the city the tunnel was filled with water, and a current flowing over the dam was observed at all five of the wells. The mains were filled as soon as the pumps could be set at work, and although no limit has ever been placed upon the use of the water, the supply has never at any time been lowered below the top of the dam. In rainy weather and in dry weather the volume of water has remained the same. It is free from all vegetable or mineral impurities and is cool and sweet.

What was considered by many as a doubtful experiment has proved a complete success. This supply is without parallel in the history of water works, unless it be at Chattanooga, Tenn., where the supply is obtained from an underground river flowing in Nickajack Cave beneath Lookout Mountain.

There engineering skill drove a tunnel into the side of the mountain until the river was tapped at the point where it dropped over the rocks, forming an immense underground waterfall. That water is as pure and sweet as that at Galveston, but there is not the quantity, nor can it be stored for emergencies as can the water at the latter point.—*Water and Gas Review.*

The Bering Sea Controversy.

The *Christian at Work*, in a few words, explains the whole matter:

"The pivotal question before the Court of Arbitration now sitting at Paris for settling the Bering Sea controversy between this country and England will be, What rights did Russia cede to the United States with Alaska? A recent report made by a Russian commission becomes in this relation important. In that report it is claimed that Russia has territorial jurisdiction to the distance of thirty miles only from the islands in Bering Sea which she still retains. This would seem to imply that Russia's claim of jurisdiction over the islands ceded to us extended also only to a distance of thirty miles. If that be the limit of our rights, then pelagic sealing is clearly no trespass if it occurs no nearer than thirty miles. But however the matter may be decided, even if England has the right to fish within thirty miles of the coast, there should be no difficulty in negotiating a fair treaty with England for the protection of the seals, in which both countries are interested."

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

METALLIC TIE.—Samuel McElfatrick, Princeton, Ky. This is an improvement on a formerly patented invention of the same inventor, providing a tie with but little metal, so disposed as to make the tie very strong, and in such form that it can be rolled at little cost, and readily applied to the rails without the use of bolts or spikes. The tie consists of two parts, each of a general T shape in cross section, the flat or top portions of the parts being adapted to fit together, and one of the parts having its upper web portion cut away to receive and clamp the outer edges of the rail bases, while the other part has such web portion cut out to fit and clamp their inner edges, thus holding the rails securely.

CAR COUPLING.—Henry W. Dennis, Natick, Mass. In the head of the drawhead of this coupling is an opening having a spherical recess in its bottom, and the coupling link has a head with a segmental offset on its under side engaging this recess, thus forming a ball and socket joint between the drawbar and the link. The link is secured to a projecting arm from a shaft mounted on the end of the car, and engages the vertical slot of a dog pivoted in the drawhead, while there is a lifting device to lift the dog out of its normal position to uncouple the dog and link. The construction is simple and durable, the coupling being automatically effected as the cars come together, and it not being necessary to go between the cars to uncouple them.

CAR COUPLING.—William S. Campbell, Hamer, S. C. This invention covers an improvement in couplers of the side latching or Janney type, the device coupling automatically with another coupler of the same kind, and the uncoupling being effected from either side of the car. A latch block pivoted in a front enlargement of the drawhead has a lateral jaw and a rearwardly extending limb engaging a tumbler block pivoted in the drawhead chamber, a pivoted locking dog in this chamber having a lip interlocking with a lip on the tumbler block, while a looped plate spring in the drawhead bears on the tumbler block and locking dog.

CAR COUPLINGS.—James H. Swindell, Reidsville, Ga. Two patents have been issued to this inventor for couplers of comparatively simple and inexpensive description, and easily operated, designed to facilitate the automatic coupling of cars as they come together, and permitting uncoupling without going between the cars. In one of the inventions there is combined with the drawhead a link lifter having crank arms or levers supported by plates pivotally secured to the drawhead, the supports being held to rock and slide on the drawhead, and projected and retracted to support and release the arms. By means of the link lifter the link is adjusted in position to couple with an approaching drawhead. To uncouple, the coupling pin may be raised by means of a cord or chain extended to any convenient position on the car, or by a transverse shaft having crank handles at the side of the car. In the other invention, besides the same general features of construction, the double-armed coupling pin has its guide arm provided with a shoulder engaged by a spring latch, there being automatically operating devices to release the latch.

STREET CAR FENDER.—William Leonhardt, Baltimore, Md. This is a device formed of pneumatic tubing and coiled springs, made into a framework projecting from the car just above the track, so as to travel over ordinary obstructions, but designed, on striking a person, to yield and become partially compressed, pushing the body forward, and thus preventing fatal accidents. It is of inexpensive construction and designed more especially for use on cable and electric cars.

Electrical.

CLOSED CONDUIT FOR ELECTRIC RAILWAYS.—Archibald J. Martin, Philadelphia, Pa. This invention provides a tube made in longitudinal sections, having its conducting section insulated from the other section, with conducting stems passing from the conducting section through the other section, and with metal track slips on the outside of the tube. The inclosing jacket of the conducting section has its edges caught and retained between the sections of the tube, and a filling of non-conducting material is placed between the jacket and conducting section. The conductor and its attachments are designed to be placed under ground in a conduit, though they may be otherwise used.

JUNCTION BOX.—James J. Powers and Robert Van Buren, Brooklyn, N. Y. This is a connection box and fitting for electrical conduits, to permit of laying the conduit without break, and at the same time allow of making connections without disturbing the conduit. A conduit section of clay or similar material is provided with longitudinal holes and a side opening, while a metallic fitting to the side of the conduit section has inwardly projecting, apertured ears, with eye bars entering the holes of the conduit section, and bolts passing through the eye bars and the ears of the fitting.

Agricultural.

CULTIVATOR. — Charles H. Harmon, Donald McRae and Alexander McRae, Milton, Oregon. This is a light weight and strongly built machine, designed more particularly to cultivate summer fallow ground, destroying the weeds by cutting them off below the surface and turning them up to die, while the shovels stirring up the ground clear themselves of all trash. The shovels are horizontally arranged, and have vertical standards held for vertical and rocking movement, a rocking movement being imparted to a front and rear series of standards in reverse direction. As the shovels are lowered into the soil they have a sidewise movement to cut off the weeds at a point below the surface, first presenting a cutting surface to the ground and then releasing.

STUBBLE-LAND WORKER. — Edward Hovey, Devil's Lake, North Dakota. This is a strong and simple machine, having but few parts, by which stubble land may be worked without plowing or harrowing. Upon forward and rear frames pivoted upon the axle are shafts, the forward one carrying rigid teeth slightly curved, and the rear shaft having spring teeth with greater curve, there being a sprocket operating chain connection between the forward and rear shafts, while upon the central axle are teeth, revolving between the teeth at the front and rear, to keep them clear from weeds, etc.

HORSE HAY RAKE.—Charles L. Dittemore, Post Falls, Idaho. An attachment whereby the rake head may be raised and lowered at the option of the driver is provided by this invention, the rake head being moved up and down in a steady and uniform manner. On the supporting axle to which the rake is pivotally attached are mounted ratchet wheels turning in opposite directions, and latches carried by the rake head are adapted for engagement with each ratchet wheel, there being trip devices with which the latches engage. A train of gearing utilized for raising and lowering the rake may be varied in combination, that the rake may be operated rapidly or slowly.

CHURN.—Daniel A. Fiske, Sioux City, Iowa. This churn has an outer water space, by means of which the cream may be kept at the desired uniform temperature, and an inner cream receptacle, the cover inclosing both the outer and inner vessels. In the cover is a vertical slot, in the center of which the dasher moves, and through which air is admitted to the cream while it is being churned. The churn may be conveniently operated and easily kept clean.

FRUIT PICKER.—George E. Hawes, Palatka, Fla. This is a hand device by means of which one can with one hand conveniently clip the stems of the fruit and allow the fruit to fall into a bag held below and attached to the cutters, without injuring the fruit, the other hand being left free. An open-ended case has a slot through its sides at the open end to receive the stem of the fruit, finger-operated cutting blades working in the case, and a spring controlling the movement of a sliding blade.

Miscellaneous.

AMALGAMATOR. — Nathan L. Raber, Corvallis, Oregon. This is an improvement in machines employing mercury, providing simple means whereby the pulp, sand, etc., are properly directed to the mercury, and for keeping the mercury constantly sensitive. The main frame has a series of steps upon which the mercury cups are independently supported in connection with devices to direct the material from each step into the mercury cup of the next lower step. The adjustments are independently effected, so that either the main frame or the mercury cups may be adjusted to different angles to the horizontal without necessitating a corresponding change in other parts.

REFRIGERATING SHIP.—John McIntyre, Jersey City, N. J. The main body of the hull of the vessel consists of a storage compartment in which may be placed fruit, meat and other perishable freight, the compartment having a false perforated bottom forming an air distributing chamber to which air is admitted under pressure from a chamber supplied by a blower, there being in the latter chamber a coil of pipe through which a cooling fluid is forced.

FLUE BRUSH.—Joseph H. Davis, Sewickley, Pa. This brush is composed of a tube with rows of apertures for the passage of the bristles, which are bent in the middle and passed through the apertures, a wire back of each row of apertures passing inside the loop of each bunch of bristles, while a tubular lining forms a cover for the wires and bent-over portions of the bristles. Each bunch of bristles is thus completely protected by the lining, and the brush will last until the bristles are worn off at their outer ends.

LIFTING JACK.—Herman Reichwein, New York City. An upper lifting section of this device has a sliding movement in the divided upper end of the base section, and the lift lever comprises a handle and a segmental toothed head fulcrumed between the upper members of the lower section, while a segmental gear eccentrically pivoted in the lifting section meshes with the teeth of the head of the lift lever. The device is very strong and simple and may be used as a wagon jack or wherever a jack is required.

MEAT WEIGHING APPARATUS.—John T. Tavenner, Parkersburg, W. Va. This is an apparatus for weighing bacon or other meat, where it is desired to weigh and cut off a part of an undivided whole, allowing one, two, or more pounds to be cut off, as desired, without cutting pieces too large or too small. The scale platform consists of a box or frame having a series of adjacent independently compressible counterbalanced supports. The meat is adjusted along the supports until the desired quantity to be cut off is ascertained, when a division line between the supports of different sections indicates the line of cut to divide the weighed from the unweighed quantity.

FORMING GLASS DOMES.—Hugo Heckert, Halle-on-the-Saale, Germany. Flanged glass domes may be conveniently and rapidly formed from flat glass plates, for optical and other purposes, by a method patented by this inventor, which consists in clamping a flat glass plate at its edge between rings, and then subjecting the clamped plate to heat, to permit the middle part of the plate to sag to form a dome-shaped glass or bowl, a larger or smaller dome being thus formed, according as the heat is more or less intense. This method may be utilized for making concave and convex mirrors, lenses, and other articles for optical purposes.

DOOR LOCK.—Bradford S. Miles, Gray's Summit, Mo. This is a combined lock and latch of durable and inexpensive construction, and designed to be as reliable as others which are more expensive and complicated. A pivoted swinging latch bolt is arranged to normally project from the lock case and engage a beveled hasp or hasp plate, in combination with rotatable operating devices and pivoted locking devices of novel character, the parts of the lock falling to their places by gravity alone, thus avoiding the friction of springs.

BREAST STRAP ATTACHMENT.—Horace B. Forbes, Ogden, Utah Ter. Two overlapping and detachably connected plates are adapted to be secured upon a breast plate, one of the plates being provided with a projecting staple or loop for connecting with a pole strap. The attachment, applied to the breast plate of an ordinary single harness, adapts the harness for use as a double harness, thus in many cases obviating the necessity of keeping two sets of harness, and enabling two horses, when provided with single harness, to be hitched into a double rig.

COMPOSITION FUEL.—Harriet Carter, Brooklyn, N. Y. According to this invention the following named ingredients are mixed to form a composition for saving fuel: Powdered and sifted hard coal ashes, granulated hard coal, sand, fire clay, and salt, in specified proportions, water being added and the composition being formed into balls and baked. After the balls have become incandescent in a fire they add largely to its heat, and are designed to retain their form for a continued use of more than a week.

HOISTING DEVICE.—John Motheral, Mendon, near North McGregor, Iowa. This is an improved derrick, which is also capable of use for grubbing or stump pulling, the invention being an improvement on a formerly patented invention of the same inventor. The device may be mounted on a post for use as a derrick, or on a stump or grub for grubbing, and the construction is such that the derrick arm may be removed from the body and quickly stepped in it, either before or after the body of the machine has been mounted on its support.

SPONGE OR BREAD-RAISING OVEN.—William O. Silvey and Lemuel Shiflet, Middleport, Ohio. This device comprises a shell having an opening at the bottom, perforations near the top, and a removable cover, a bread pan being supported in the top and a lamp for heating purposes in the bottom, there being also a central horizontal partition with an air space around its edge. The device provides a simple means for maintaining an even temperature in the pan, and is an improvement on a former patented invention of the same inventor.

BOOT CLEANER AND POLISHER.—Sigmund Bonne, Nuremberg, Germany. This is a machine in which a revolving cleaning brush, a revolving dauber, and a revolving polishing brush are all loosely, independently, and adjustably mounted, to be operated by steam or foot power as the operator holds the boot or shoe, which is first cleaned, the blacking being then applied, followed by the usual brushing to produce a polish.

ANIMAL GUN.—Breese Riggs, Crowley, Oregon, deceased (Seth Riggs, executor). This is a device for use in extermination of gophers, moles, etc., being operated by the animal approaching the muzzle, the gun having been placed in advantageous position. The barrel is connected by a sleeve with a detachable breech tube, facilitating the introduction of the cartridge, and the firing pin is locked in set position by means of a trigger connected with a tripping rod placed in the path of the animal.

WATCH CHARM.—Benjamin G. Stauffer, Bachmanville, Pa. This is a calendar device, with a box-like body, adapted to receive a series of calendar cards, a transparent cover being hinged to the body, the hinge having an eye for attachment to a watch chain. A bezel overlying the edges of the cards forms a follower to retain compactly the remaining cards as their number is reduced.

Designs.

TABLE KNIFE. — Peter McGuigan, Ashland, Wis. According to this design the knife blade, a short distance from the handle, is broadened and concaved, the lines of the blade at the back narrowing in front of and behind the concaved part.

HEATING STOVE.—Rodney F. Schermerhorn and Ferdinand S. Weller, Quincy, Ill. In the ornamentation of this stove its doors are framed by a band having ornamental figures, there being also scroll figures and volutes above the doors and around the base. The cap or top piece also has foliate scrolls, and the latch represents a scroll.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

SOAP MANUFACTURE. By W. Lawrence Gadd. London: George Bell & Sons. 1893. Pp. x, 244. Price $1.50.

We again have a book intended to meet the requirements of students of the City and Guilds Institute of London, one therefore, to a certain extent, restricted in is scope and conforming to statutory requirements. Nevertheless the little work, which is well illustrated and has a satisfactory index of contents, will be found of value to soap makers, especially as revealing approved English methods of conducting the art.

A MANUAL OF DYEING: FOR THE USE OF PRACTICAL DYERS, MANUFACTURERS, STUDENTS, AND ALL INTERESTED IN THE ART OF DYEING. By Edmund Knecht, Christopher Rawson, and Richard Loewenthal. London: Charles Griffin & Company, Limited. Philadelphia: J. B. Lippincott Company. 1893. Pp. x, 907. Two volumes of text. One volume pattern sheets. Price $15.

This work, although its text is in two volumes, is consecutively paged. The second volume contains an independent title page, so that the purchaser may keep it in two volumes or not, as he chooses. The third volume contains a great number of samples of dyed goods pasted six to a page, with the dye used and its mordant or developer stated in each case. A total of 144 samples are contained in the book, covering, largely, of course, the coal tar colors, but also many of the natural colors. The scope of the work is excellently set forth in its very complete table of contents. The textile fibers, water, washing and bleaching acid, alkalies, mordants, etc., are the matters treated of in the first five parts, making up the greater part of the first volume. The rest of the first volume is devoted to natural coloring matters, running from indigo and logwood down the list to madder, cochineal and gambier. The second volume is devoted to artificial organic coloring matters, mineral colors, machinery used in dyeing, the tinctorial properties of coloring matters and the analyses and valuation of materials used in the art. A short appendix contains useful tables, while a very excellent index for both volumes of text in one ends the work. To artificial organic coloring matters all of part 7 is devoted, this portion alone making some 263 pages of text. The work seems exceedingly complete, and the eminently practical as well as scientific treatment of the subject will, we are sure, commend itself to all advanced technologists, as well as to the dyer.

STATISTICAL SUPPLEMENT OF THE ENGINEERING AND MINING JOURNAL. The mineral industry, its statistics, technology and trade, in the United States and other countries. Vol. 1. Edited by Richard P. Rothwell. New York: The Scientific Publishing Company. 1893. Pp. xxiii, 628. Price in paper $2, cloth $2.50.

This work is the annual statistical supplement of the *Engineering and Mining Journal*, of this city. It includes the statistics of technology and trade from the earliest times to the close of 1892. Under each metal is given its different occurrences, its metallurgy, assaying and trade figures, as may be required in each case. Another section of the work is devoted to the different countries and mining regions, the markets and a vast amount of details whose summarization cannot even be given here. The work reminds one of the government reports published under the Department of the Interior, except that it is naturally fuller and more satisfactory in the matter of markets and finances of the subjects. Besides ores and metals, many other mineral products are treated, so that the work will be found an invaluable one. A double-column solid-set index of nearly 30 pages is the best testimony we can offer to the thoroughness of the work and its value to all.

KNOTS, SPLICES, HITCHES, BENDS, AND LASHINGS. Illustrated and described. By F. R. Brainard, Ensign, United States Navy. New York: Practical Publishing Co. 1893. Pp. 76. Price $1. No index, no contents.

The illustrations and descriptions contained in this little work make clear the ways of making a reasonable variety of such knots as are most in use by the sailor. The subject is an interesting and a popular one and will, as far as the work goes, be found satisfactorily treated by Ensign Brainard.

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SCIENTIFIC AMERICAN BUILDING EDITION.

MAY, 1893.—(No. 91.)

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2. Plate in colors showing a handsome residence at Rutherford, N. J. Two perspective views and floor plans. Mr. F. W. Beal, architect, New York. An attractive design.
3. A handsome dwelling at Plainfield, N. J. Perspective views and floor plans. A model design. Messrs. Hartwell & Richardson, architects, Boston, Mass.
4. A dwelling at Utica, N. Y., erected at a cost of $4,700 complete. Floor plans, perspective view, etc. Mr. W. H. Symonds, architect, New York. An Old Colonial style of architecture.
5. Engravings and floor plan of the Fairfield Congregational Church at Fairfield, Conn., erected at a cost of $52,000. Messrs. J. C. Cady & Co., architects, New York City.
6. A stable erected at Plainfield, N. J. A model design. Messrs. Hartwell & Richardson, architects, Boston, Mass.
7. An excellent design for a modern stable at Bridgeport, Conn. Messrs. Longstaff & Hurd, architects, Bridgeport, Conn.
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9. View of a tasteful shop for a builder erected at Neuilly, Paris.
10. The Fifth Avenue Theater, New York.—View of the Worthington steam fire engine pump.—View of the Hygienic Cement and Asphalt Company's watertight scene pit. View of the Edison Electric Illuminating Company's switchboard, with particulars of construction, etc.
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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

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Minerals sent for examination should be distinctly marked or labeled.

(5070) S. E. B. writes: To settle a controversy between myself and Dr. A., please state whether or not the surface of Lake Michigan has fallen, or is eight to ten feet lower now than ten years ago. The doctor goes to Petosky, Michigan, every August, and he claims that the surface of the water in Little Traverse Bay is now eight or ten feet lower than when he first visited the place, ten years ago. I claim that he is wrong, or we would have seen some mention of the fact in some of the newspapers. A. According to one of our best authorities, Professor G. K. Gilbert, of the United States Geological Survey, who has made a special study of the great lakes, there is no steady or continuous lowering of the waters of Lake Michigan. Two years ago the lake was two feet below the average, while a few years earlier it was a few feet higher than the average, which would make an apparently continuous drop of four feet. The lake is entirely dependent on rainfall for its general level, rising during a rainy season, and falling during a protracted drought, and differs only from smaller bodies of water in this respect, that the supply from drainage or watershed of the surrounding shores is less appreciable. In the long run the average level remains essentially the same. According as the conditions just indicated vary, the Chicago river, for instance, flows to or from the lake, but were here any permanent lowering it could not be made to flow backward into the Mississippi. The writer lived in Chicago thirty years ago, and both river and lake are at the same average height they were then. Long-continued winds to or from the shore materially affect the height of the lake locally, but such influences are quite ephemeral.

(5071) C. W. M. says: Can you direct me where to find instructions for making sheet wax for dentist's use? A. Dr. H. E. Beach, Clarksville, Tenn., says: Take of pure clean wax anywhere from 1 to 5 pounds, put in a tin bucket or any deep vessel, with clear water sufficient to fill it within 2½ inches of the top. Set on the stove till thoroughly melted, then set aside until partially cooled; skim all the air bubbles off. Then fill a smooth, straight bottle with ice water, a bucket of which you should have by you. Soap the bottle and dip it deliberately in the solution two or more times, according to the thickness you desire your wax. After the last dip, as soon as the wax hardens to whiteness, cut a line through it and remove it from the bottle as quickly as possible. Spread to cool and straighten out smooth while warm. Continue this process until all the wax is made into sheets. Paraffine, or paraffine and wax, may be made in the same way and colored and perfumed to suit one's fancy. The water in the bottle should always be kept cold, in order to get the best results.

(5072) R. W. H. asks how to make a good lye. A. Hickory ashes are the best for making common washing soft soap (when it is not desirable to use the potash lye), but those from sound beech, maple, or almost any kind of hard wood except oak will answer well. A common barrel set upon an inclined platform makes a very good leach, but one made of boards set in a trough in V shape is to be preferred, for the strength of the ashes is better obtained, and it may be taken to pieces when not in use, and laid up. First, in the bottom of the leach put a few sticks, over them spread a piece of carpet or woolen cloth, which is much better than straw, put on a few inches of ashes and from 4 to 8 qt. lime, fill with ashes moistened, and tamped down well; tamp the firmest in the center. It is difficult to obtain the full strength of ashes in a barrel without removing them after a day's leaching, and mixing them up and replacing. The top should be first thrown off and new ashes added to make up the proper quantity. Use boiling water for the second leaching. This lye should be sufficiently strong to float a potato.

(5073) F. H. says: 1. Please give me the voltage, amperage, resistance, and durability of the Fuller battery, and also a description of the battery. A. The electromotive force of the Fuller battery is about 2 volts, its resistance is about 2 ohms; therefore the current will be equivalent to approximately 1 ampere on a circuit of no resistance. 2. I have four zinc carbon piles; with them I want to light an 8 volt 0·8 ampere Swan incandescent lamp. Which would be the best and cheapest filling, and how long would it last? And how would I be able to prevent chemical action on an open circuit, because I want to use the lamp every evening? A. Probably a chromic acid solution would be best, but we know of no way to prevent action when the circuit is open, and furthermore, it would soon become exhausted when used in electric lighting.

(5074) F. L. asks: 1. How many Leclanche or sal ammoniac cells will it take to ring a common bell over a 700 foot line of No. 18 annunciator wire? Would a return wire be more satisfactory than grounding? A telephone is to be used on the same line. A. Four cells will operate the line if the resistance of the bell is not too great. 2. Is it the high resistance of our bodies that causes us to receive a shock from a strong current of electricity passing through them? A. It is the effect of the current upon the nerve centers. 3. If the two arms of a U-shaped piece of steel are placed against the positive pole of a dynamo, will the two arms be of the same polarity? Will the curve or bend be the positive and the two arms negative? I have one so magnetized, and the filings arrange themselves around the middle of each arm of the magnet. A. The poles which touch the positive pole of the dynamo are negative. The fact that the filings gathered about the middle of each arm of the magnet shows that consequent positive poles were developed. 4. Does it weaken or take magnetism from a permanent magnet to magnetize other steel objects with it? A. No.

(5075) W. S. P. writes: 1. In regard to a Fuller bichromate battery. I would like to make one to hold 3 pints of Grenet battery fluid, and put the zinc in the porous cup. Can you tell what I could put in the porous cup instead of mercury? Can I use a rod of zinc? Can I make a porous cup out of plaster of Paris or out of white clay? A. There is no substitute for mercury in the Fuller battery, and although you can use a rod of zinc if you desire to do so, the cone used in the regular Fuller battery is preferable. A plaster of Paris cup is of no value in a battery of this kind; you can, however, make the cells out of white clay baked; but as porous cells cost very little, we think you would derive more satisfaction from the regular manufactured one.

(5076) H. M. W. says: We are having a good deal of trouble in our trimming department with moths. Can you give us any remedy whereby we can fumigate our rooms and kill the moth flies and moth worms? Reply by Professor Riley: The insect complained of is probably either the buffalo moth or more properly the carpet beetle (*Anthrenus scrofulariæ*), or the common case-bearing clothes moth (*Tinea pollionella*). The first of these insects I have treated in *Insect Life*, Volume II., pp. 127–130, and the latter is illustrated on page 212 of the same volume, in the article upon clothes moths, which covers pages 211 to 215, to which for details I would refer. Briefly, I may summarize the life histories of the two species as follows: The larva of the carpet beetle is brown in color and is clothed with stiff brown hairs, which are longer around the sides than on the back, and still longer on the extremities. It is elliptical in form and active and it is in this stage that the greatest damage is done. The perfect beetle is 3-16 of an inch long, broadly elliptical in shape, and black, white, and scarlet in color. The beetles begin to appear in the fall and continue to issue throughout the winter and spring. Under ordinary circumstances there is probably but one annual generation, although with plenty of food and a high temperature there may be more. The case-bearing clothes moth is light brown in color and begins to make its appearance in May, and may occasionally be seen flying as late as August. The female lays her eggs in dark corners and in the deep folds of garments, the white soft-bodied larvæ making cases for themselves in the fragments of cloth upon which they feed. The case is in the shape of a hollow roll or cylinder and the interior is lined with silk. When full grown they transform to pupæ within their cases, sometimes leaving the cloth and crawling to some distance to transform. Of this insect also there is but one annual generation. A thorough spraying with benzine will kill either of these insects in all of their stages, but as the company wishes to do something in the way of fumigating, they can do no better than to close the infested rooms tightly over Sunday, arranging the trimmings so that they are not in compact masses. Then place here and there, on shelves and step-ladders, open vessels containing bisulphide of carbon, the rapid evaporation of which will fill the room with its deathly vapor and destroy all, or nearly all, of the insects. The amount to be used depends upon the cubic contents of the room to be treated. It is safe to say that one pound to each one thousand cubic feet will be sufficient, but the proportions may be increased somewhat without danger. Thus, one pound will suffice for a room 10×10×10, but eight pounds would be required for a room 20×20×20. As before stated, the room should be closed as tightly as possible and left for 24 hours. It should then be thoroughly aired and every precaution should be taken to avoid the introduction of fire or light into the room until the vapor has thoroughly dissipated, as it is very inflammable and explosive when at all compressed. A thorough trial of this remedy will probably prove satisfactory.

(5077) A. W. writes: As you are frequently publishing simple modes of illustrating physical principles, I send you something which I trust you will find new. Cut a strip of opaque paper, and hold it horizontally before the flame of a lamp turned edgewise. On looking at the paper with one eye closed, it will appear to be notched where it cuts the flame. This is caused by the persistence of the bright image of the flame on the retina, and is one more instance that the eye cannot see two things that are separate at one and the same instant. A. The effect to which you refer is not due to persistence of vision, but to irradiation. The appearance of the notch is caused by the sympathetic action of the retinal nerves adjoining those directly acted upon by the light.

(5078) J. T., Jr., writes: 1. I have a Bunnell battery, such as is used for telegraphing. Will it run a small Gramme ring motor described in SCIENTIFIC AMERICAN, January 17, 1891? A. Yes. 2. How many cells of this battery will run a sewing machine motor? A. A gravity or sulphate of copper battery is not suitable for running electric motors designed for doing any great amount of work. 3. Is there an electric motor for running sewing machines on the market, and are they any good? A. Such motors are on the market and they are used more or less. You will find them referred to in our advertising columns. 4. What book on electricity for amateurs would you recommend? A. We would recommend "Experimental Science," price by mail $4; and Ayrton's "Practical Electricity," price $2.50.

(5079) W. H. B. asks: 1. In making zincs for medical batteries is anything but pure zinc used? A. No. 2. Should the zincs for medical batteries be amalgamated with mercury? A. Yes. 3. Give most approved formula for making medical battery fluid. A. It depends upon the kind of battery. If it is an ordinary Grenet battery, use a bichromate solution made by dissolving bichromate of soda in water to saturation, then add one-fifth its volume of common sulphuric acid. If it is a chloride of silver battery, the solution may be one chloride of ammonium, or of common salt.

(5080) H. R. E. asks: By what name is caustic magnesia known to the trade, and is it dangerous to handle? A. Calcined magnesia is the form in which the oxide occurs in commerce. This is the anhydrous oxide MgO. The hydrate or caustic magnesia Mg $(OH)_2$ occurs as the mineral brucite. There is no danger in handling them.

(5081) W. H. asks how to make nitrite of soda from nitrate of soda. A. Fuse with lead or copper filings, dissolve in water, filter, and evaporate to dryness.

(5082) J. P. L. writes: I have read that large masses of cast iron could be broken by drilling a hole in the most solid part of the casting, and filling it with water and fitting a steel plug in the hole, and by striking it with a drop the casting would break. Why is it that cast iron can be broken in this way? A. An enormous hydraulic pressure can be thus produced, which breaks the metal.

(5083) L. H. H. asks for a recipe for obtaining a good black color on cast brass name plates, such as are put on various machines by the makers. A. The letters are filled in with the following composition: Melt together in a clean iron pot 2 parts each of best asphaltum and gutta percha, stir well together, and then add 1 part of gum sheilac in fine powder. It may be used hot and mixed with smalt, vermilion or other pigment, if desired.

(5084) C. De W. S. asks: 1. Can a person run electric lights with the same batteries that are used for telegraph? A. The resistance of telegraph batteries is too great to permit of their use for electric lighting purposes. 2. What is a good receipt to paint blackboards with, so that they will not act greasy and the chalk will rub off clear and clean? A. Five pints of 95 per cent alcohol, 8 ounces of gum shellac, 12 drachms of lamp black, 20 drachms ultramarine blue, 4 ounces powdered rottenstone and 6 ounces of pumice stone.

(5085) W. M. C. asks: What does the term tons mean when used to indicate the size of a ship? I had the idea that it meant the weight of the ship, but have recently heard that it denoted the carrying capacity. Which is correct? If the latter, what does the word displacement mean, used in the same connection? As for instance, the size of the United States ship Philadelphia is given as 4,324 tons displacement. A. Displacement is the weight of a vessel and is named in tons of water that it displaces. Tonnage is the carrying capacity of a vessel.

(5086) W. F. Z. asks: Will you please inform us which is the best and cheapest paving for a mud street in a town of 5,000 to 10,000 inhabitants? A. The cheapest in first cost is wood. Cheapest, considering durability, is brick. It might be well for you to examine the various exhibits at the World's Fair, relating to pavements and roadways.

(5087) J. F. S. asks: 1. Are Leclanche batteries capable of lighting the small Edison incandescent lamps, say from five to ten minutes at a time, three or four times per night? A. Yes. 2. How many cells will be required to run two lamps of 4 and 6 candle power, connected in series? A. The lamps of this size are rather large for use in connection with Leclanche batteries. It would require about 10 cells for a 6 candle power lamp and 8 for the 4 candle power. 3. What is the greatest distance the common form of Bell telephone with Blake transmitter has worked successfully? A. Under favorable circumstances, 100 miles or more. 4. What is the multiphase motor? A. The multiphase motor is one in which the current is distributed in the field magnet in such a way as to cause the field to rotate, the poles of the armature following the poles of the rotating field.

(5088) B. E. W. asks: Please say how the tin or iron enameled ware, commonly known as granite ware, is made, and if it could be made on a small scale by a person not skilled in the work. Also, does the blue and white enameled ware made in Germany differ from it except in color? A. Gray enameled ware is done in same manner as the white cast iron ware. It only requires more care in handling and firing the sheet iron goods. The gray color is made by a uniform coat sprinkled with the darker enamel from a brush. In the finest ware two to three firings are required to make the finish. The process and composition of the enamels is described in "Techno-Chemical Receipt Book," $2 mailed. The German enameling is of the same kind as made here, only different color. We do not advise amateurs to try this style of enameling. It requires some skill, a properly built oven and technical knowledge in compounding the enamels.

(5089) B. M. W. asks: Can you give me any information regarding a paint that could be used on iron pipes and vessels that are heated from the inside by steam, the temperature on said vessels not to go over 300° Fah.? All the paints I have tried so far burn off in from 2 to 4 hours. Also a receipt for mending pin holes in rubber air pillows. A. Steam pipes for high pressure steam are usually painted with coal tar or liquid asphalt. Red oxide of iron paint (dry) mixed with boiled linseed oil only is much used on steam pipes. Use rubber cement for mending pin holes in rubber pillows; push the cement through the hole with a small stick while the pillow is partly filled with air and allow it to thoroughly dry before using.

(5090) C. L. asks: 1. About what degree of heat is produced in the oven of any one of the cooking stoves or ranges used by the people of to-day? A. Baking ovens have a range of temperature for cooking from 250° to 350° Fah. 2. Please give three or four metals which possess the greatest expansive properties, yet will not fuse in this heat. A. One of the metals that has the greatest range of expansion by heat is zinc, which melts at 680° Fah. It will expand 0·005 of an inch in 10 inches length for 268° change.

(5091) A. B. asks: Will you please tell us what composite and scrophulariaceous plants are? They are spoken of in a bulletin of the United States Department of Agriculture, Division of Entomology, in connection with buffalo beetles. A. Composite plants include the very large number of plants belonging to the natural order Compositae. Among them as more particularly attractive to the buffalo or carpet beetle (*Anthrenes scrophulariæ*) are the daisies, chrysanthemums, asters, and solidagos or goldenrods. Scrophulariaceous plants, in the same way, include those belonging to the natural order of that name, and among those most attractive to the carpet beetle are the true figworts (Scrophularia) whence the specific name of the insect, the mullein (Verbascum) and the foxglove (Digitalis).—C. V. R.

(5092) K. S. G. asks if there is an electric motor made that will run a 20 foot boat from 3 to 5 miles per hour, using a plunge or any cell battery that will be practical? A. Any of the well known makers of motors could furnish you with a motor that would run the boat easily at the speed stated. A storage battery would be required for the best results. For addresses of makers of electric motors we refer you to our advertising columns.

(5093) J. L. K. asks for the best way to mould sheet zinc into rods the size of carbon pencils. A. You can melt and cast your zinc into rods, using sand moulds. 2. Could I run the simple motor described in "Experimental Science" with the plunge battery made with tumblers each holding one pint, using 1 zinc rod and 2 carbon rods to each cell? If so, how many cells would be necessary? A. The battery you describe will be too small for running the motor referred to. You will be obliged to make a large battery like that described in "Experimental Science."

(5094) J. Q. D. writes: I can find no reliable data as to the proper sp. gr. to make brine for refrigerating purposes. As the operation is one of the abstraction of heat, would a brine just sufficiently strong to prevent freezing at the temperature of the brine tank give better results than one weighted with salt above the amount necessary to prevent freezing, and if so, to what extent? I believe the rule of thumb governs most establishments in making brine, and that therefore little or no attention has been paid to this important point. A. Brine absorbs heat according to its density, and faster than fresh water. For best effect for the least pipe surface the density should be near the saturation point, yet not near enough to produce crystallization in any part of the apparatus, as the intense cold in the ammonia expansion surface would crystallize the brine that would not show saturation by several degrees in the solution tank. We understand this point is well known among experts.

(5095) B. R. writes: 1. The beam, pans, etc., of my chemical balance have been badly corroded by fumes of nitric acid, a bottle of which was placed in the balance by mistake, and left there for some time. How can I restore the original finish to the corroded parts? A. You can only restore the balance by refinishing with flour emery cloth and relacquering. 2. What is the best form of voltaic cell for ordinary electroplating? A. Electroplating, the Smee battery.

(5096) H. S. R. writes: I wish to build a small cannon of gun metal with an inch bore. It will be more of an ornament than anything else, but of course will use it occasionally. It will not be a breech loader. Can you kindly give me information as to its proportion,

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as I wish it to be perfectly safe? A. Make the gun for 1 inch bore, 16 inches long over all, 2 inches of metal at breech, 5 inches diameter behind trunnions, and taper to 3 inches at muzzle.

(5097) D. T. S. asks: Suppose you take two iron balls, one weighing one hundred pounds, one weighing fifty, elevate both to the height of 200 feet from the earth, and drop both at once, which will strike the ground first? A. The large ball will reach the ground first, owing to less air friction in proportion to the weight.

(5098) A. W. G. asks for the formula for making the compound used by rubber stamp makers to make matrix or mould of. A. Soapstone (powdered) 1 pound 3 ounces; dental plaster, 1 pound; finely powdered kaolin, 1 pound; mix dry, sift and mix with the following solution, which is made by dissolving 5 ounces of dextrine in 1 quart of hot water. This solution is to be used cold and is made in advance. The composition should be about as stiff as putty or a little stiffer.

(5099) L. G. E.—Soft brass castings are easy to make if you use good copper 2 parts, zinc 1 part, by weight. This is called 8 ounces brass or 8 ounces of zinc to a pound of copper. The "Brass Founder's Manual," by Graham, will probably set you all right. $1 mailed.

(5100) F. C.—You should be able to maintain 12 pounds vacuum per square inch upon the largest piston of your compound engine. The connecting pipe and pump should be a little larger than is necessary for discharging the water of condensation, as it has also to discharge the air in the feed water of the boiler.

TO INVENTORS.

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AND EACH BEARING THAT DATE.

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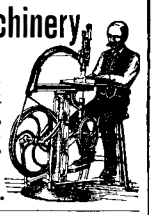

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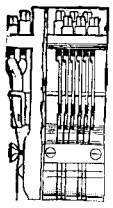

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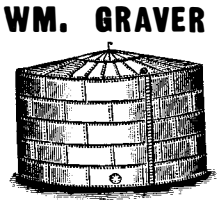

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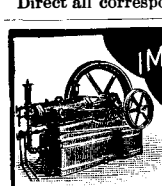

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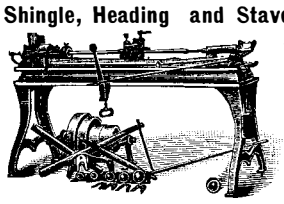

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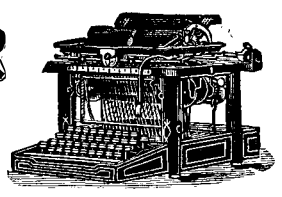

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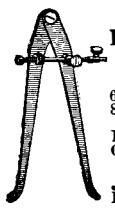

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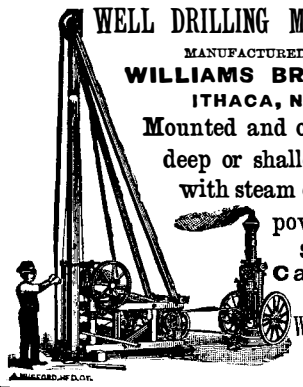

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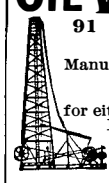

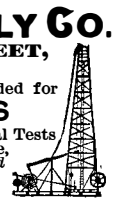

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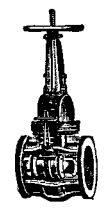

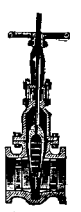

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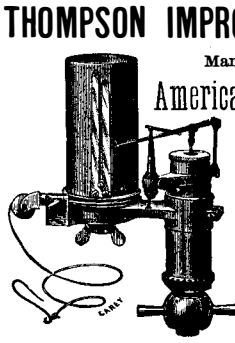

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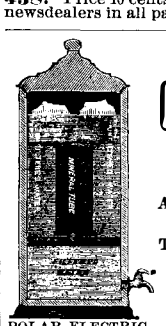

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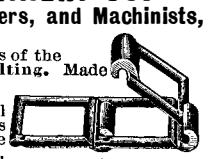

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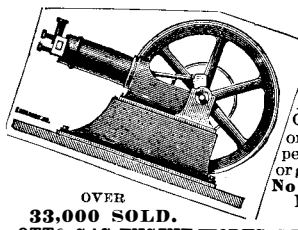

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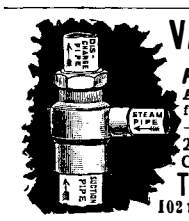

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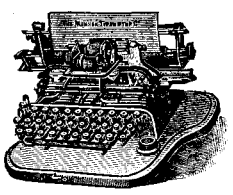

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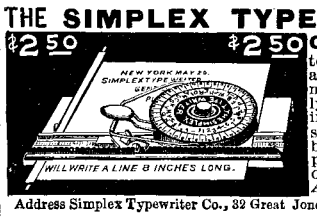

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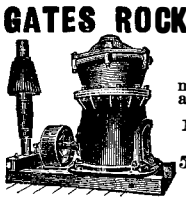

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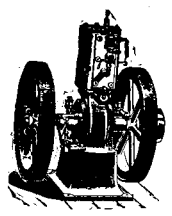

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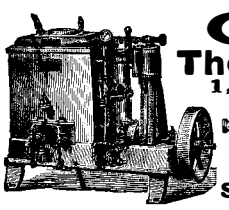

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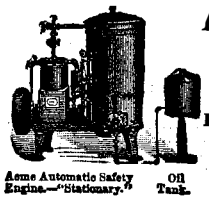

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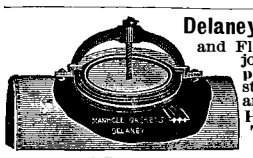

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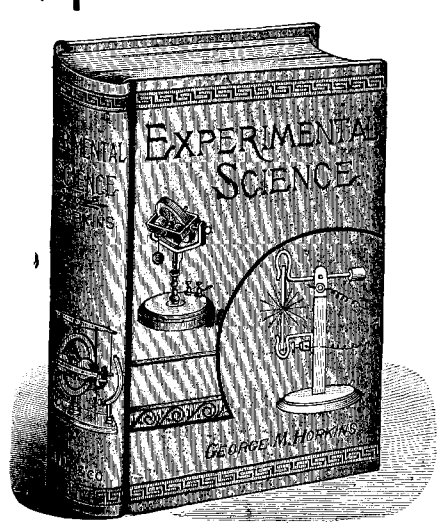

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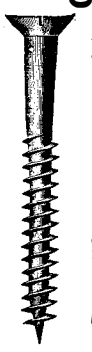

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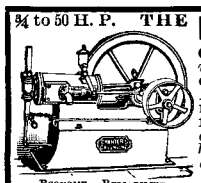

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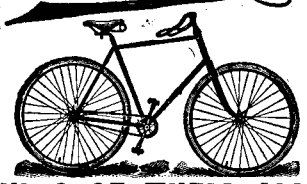

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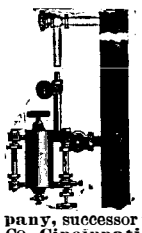

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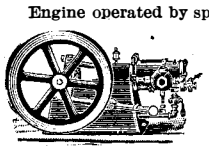

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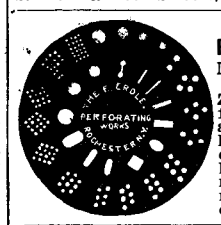

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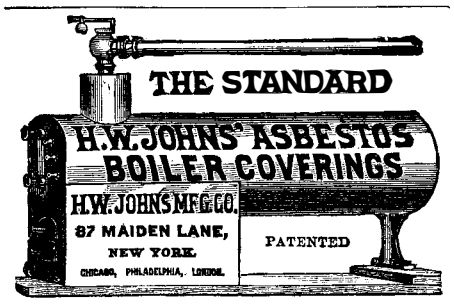

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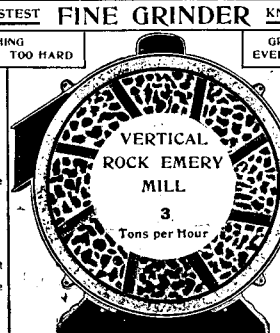

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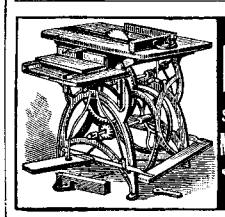

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This Company owns the Letters Patent No. 186,787, granted to Alexander Graham Bell, January 30, 1877, the scope of which has been defined by the Supreme Court of the United States in the following terms:

"The patent itself is for the mechanical structure of an electric telephone to be used to produce the electrical action on which the first patent rests. The third claim is for the use in such instruments of a diaphragm, made of a plate of iron or steel, or other material capable of inductive action; the fifth, of a permanent magnet constructed as described, with a coil upon the end or ends nearest the plate; the sixth, of a sounding box as described; the seventh, of a speaking or hearing tube as described for conveying the sounds; and the eighth, of a permanent magnet and plate combined. The claim is not for these several things in and of themselves, but for an electric telephone in the construction of which these things or any of them are used."

This Company also owns Letters Patent No. 463,569, granted to Emile Berliner, November 17, 1891, for a Combined Telegraph and Telephone; and controls Letters Patent No. 474,231, granted to Thomas A. Edison, May 3, 1892, for a Speaking Telegraph, which cover fundamental inventions and embrace all forms of microphone transmitters and of carbon telephones.

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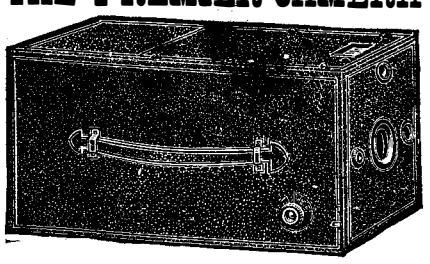

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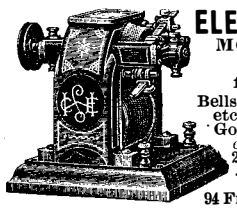

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